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AND

GENERAL SCIENCE.

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[OFFICIAL NOTICE.]

July Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, June 21, 1895.

The July meeting of the Guild of Gas Managers will be held in Young's Hotel, Boston, Mass., at noon, July 13th.

A. K. QUINN, Secretary.

BRIEFLY TOLD.

THE '95 MEETING OF THE INCORPORATED GAS INSTITUTE.—The 32d annual general meeting of the Incorporated Gas Institute was brought off at Edinburgh, Scotland, on the 11th, 12th and 13th of June, under fair skies, with a good attendance, an excellent programme and perfect harmony. The President (Mr. Robert Mitchell) kept the meeting well in hand, and despite the many and varied attractions of the city to act as magnets in withdrawing and withholding the delegates from their chairs in the convention room, it is to the credit of the members that they kept to the sessions rather than strayed about in sight-seeing save at the hours appointed for such indulgence. Curiously enough the Council awarded the first prize for papers read at the 1894 meeting to Mr. James Stelfox, of Belfast, for the paper descriptive of his first season's experience with carbureted water gas; the curiosity about it being that a dissertation on carbureted water gas could hold the palm, not that Mr. Stelfox did not treat the theme in prize-worthy fashion. The other prizes were awarded to Mr. W. R. Chester—who was also elected President of the Institute for the ensuing year—and to Mr. William Chew. The paper list carried 10 numbers and an 11th communication, by Mr. F. H. Medhurst, which was taken as read through the failure of the author to attend the meeting. Of the 10 set numbers, two were lectures really, the first being on "Illumination," by Professor Ivison Macadam, of Edinburgh, and the second was by Professor V. B. Lewes, who spoke on "Acetylene and the Part it Plays in the Luminosity of Flame." Judging from our reports of the meeting, this lecture or paper must be considered the star number of the programme, since many of the Professor's sonorous phrasings and simple experiments were received with enthusiasm. It pleases us to add that the Professor, however, has rejected the estimates of last February respecting the cost of manufacturing calcium carbide and the price at which it can be put on the market; in fact, his estimates thereof now are quite in accord with those especially prepared for the JOURNAL by Mr. Fred. Bredel, C.E., and which appeared in our issue for February 25, p. 260. But of this we will speak again. The membership lists were lengthened by the addition of 56 names, and the President of the Association of French Gas Engineers was elected to honorary membership in the Institute. Mr. Hepworth, the Honorary Secretary of the Institute, declined a reappointment, and his successor is to be Mr. Andrew Dougall, of Tunbridge Wells. The deaths during the year numbered nine, and included Mr. George Garnett, of Ryde, who in the stormy times of 1889 was the Acting President of the Institute, and who filled the Presidential Chair in 1890 with marked ability. The place for the next meeting is to

be London. Take it all in all, the members have reason for congratulating themselves over the complete success of the '95 meeting.

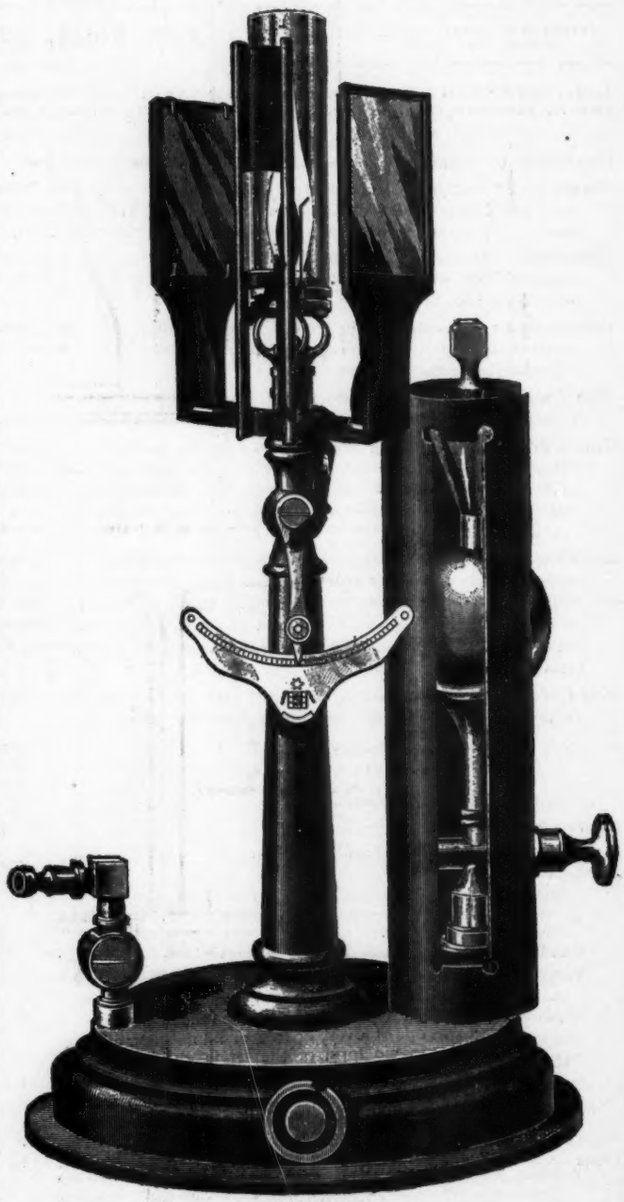
PROF. LEWES AND THE COST OF CALCIUM CARBIDE.—The gas makers of this country, in the summer of 1894, were not a little exercised over statements which emanated from what had as a rule theretofore been considered reliable authority, that a new product from the electric furnace was about to be put before them which would revolutionize the art of making gas. In due time the statements were crystallized to the point of revealing the identity of the substance, which turned out to be carbide of calcium, a substance resulting from the fusion in an electric furnace of certain named proportions of carbon and lime. The carbide, through conversion in water, yielded acetylene gas, the reaction being accomplished almost without expense. As the readers of the JOURNAL, by means of the articles published in it, are quite conversant with the principles of the production of the carbide, of the manner of its conversion into gas, and of how the gas can be employed commercially, we do not propose here to go into the details thereof, but intend merely to show that a better understanding is being arrived at as to the actual cost per ton of manufacturing the article in question. The statements of the summer were followed by renewed arguments in the fall over its possibilities, and in October, during and after the meeting of the American Association, the Mecca of many a gas man was the office in this city of Mr. T. L. Willson, the putative father of the new gas making material. The claims of Mr. Willson and his associates that the carbide could be produced for less than $15 per ton were very pronounced, and at that figure the practical gas makers were ready to hail it as a hope against the encroachments of the oil purveyors, who since the beginning of the year had been gradually increasing the price of their goods. The study of the market value of carbide of calcium was an engrossing one during the winter, and when Prof. Lewes, on January 16th, 1895, delivered his now famous lecture before the Society of Arts (England) on the "Commercial Synthesis of Illuminating Hydrocarbons,"[1] his presentation of the matter more than redoubled the discussion. In that lecture Prof. Lewes said: "At the present time private information from America shows that calcic carbide can be produced at a little under $20 a ton, and the beautifully pure lime obtained by the decomposition would be worth to the gas manager at least $2.50 a ton, and as a ton of the carbide will give rather more than 1¼ tons of quicklime or 1¾ tons of slaked lime, $17.50 may be taken as the cost of the acetylene produced from a ton of the material, and will leave a margin for handling. A ton of the carbide will yield in practical working 11,000 cubic feet of acetylene, which will bring the cost of the gas out at $1.59 per 1,000." We then asked Mr. Fred. Bredel, an engineer well qualified in every respect for the task, to prepare for our readers an estimate of the cost of producing a ton of calcium carbide by electrolysis, the estimate to be adjusted to conditions favorable for the production on the score of cheap coal, lime, labor, power, and so on. The result of his studies was the figure of $40 per ton of 2,000 lbs., as per his contribution to our pages in the issue for February 25th. Col. M. P. Wood, also at our invitation, submitted figures (JOURNAL, March 25th and April 1st.), which substantially accorded with those given by Mr. Bredel. All the arguments tended later on to confirm our position, despite the continued claims of Mr. Willson and his associates that $15 was the "fair figure;" and our satisfaction is found just now in the knowledge that Prof. Lewes, in his lecture last month before the Incorporated Gas Institute, on "Acetylene and the Part It Plays in the Luminosity of Flame," had this to say regarding the cost of calcium carbide: "The data as to cost which have been from time to time supplied from America vary in the most extraordinary way and between extremes which are both equally ridiculous; and the readers of gas literature will have noticed that even as late as last month, in a paper read before the Franklin Institute, it was stated that there was a probability, or at any rate a possibility, of making carbide at about $5 per ton. But this appears to me to be an absolute impossibility, even with the cheapest of cheap water power to generate electricity; and we shall have to look nearer home for data as to this question of cost, if we are to form any idea on this point. I have information which I believe to be reliable, to the effect that in Germany the carbide is being made at 170 marks, or practically $42.50 per ton; and experiments carried out in England point to the possibility of making it in bulk at about $47.50 a ton. * * * Looking at these facts, I think it will be safe to say that the cost of making it will be between $40 and $60 per ton, and the selling price will be between $50 and $70 per ton." Which leads us to remark that our information in these respects, printed as far back as February 25th, or something over a month after Professor Lewes' remarks before the Society of Arts, is quite up to his information as submitted to the Gas Institute last month.

1. See JOURNAL, Feb. 4, 1895, p. 146.

Dibdin's 10-Candle Pentane Air-Gas Standard.

At the May meeting of the Incorporated Institution of Gas Engineers a feature of the proceedings was the report of "The Work of the Photometric Standard Committee," which was submitted by Prof. Vivian B. Lewes, F.I.C., etc. During the reading of the paper the Professor exhibited the standard—known as the Dibdin 10-candle pentane Argand air gas standard—which the Committee advised should become the standard for official gas testing in England, and for the following illustrated description of the same we are indebted to the *Journal of Gas Lighting:*

The apparatus used in producing this standard consists of two separate portions—viz., the burner and the carburetor. The burner is a specially constructed tri-current Argand burner, the annular steatite ring being perforated with 42 holes, each hole being 0.71 millimeter in diameter. The three air currents are: (1) The central current rising inside the steatite to the inner portion of the flame; (2) a current rising outside



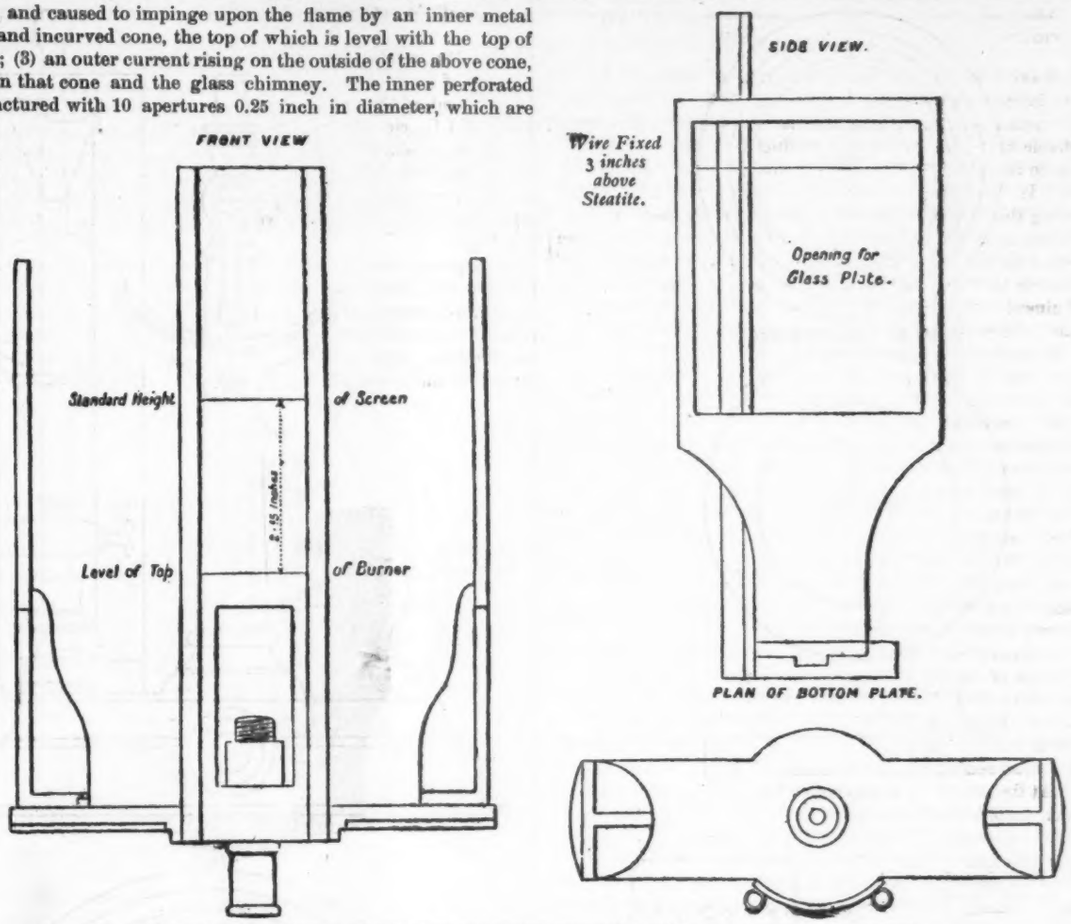
Dibdin's Pentane Argand and Carburetor.

Measurements of Burner.

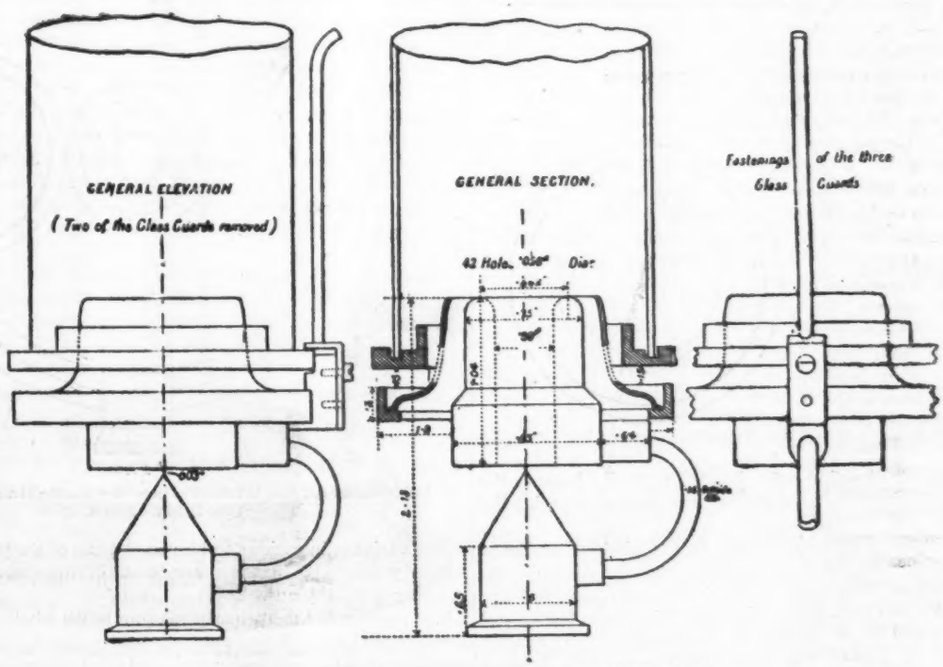
Number of holes	42			
Diameter of holes	0.71	mm.	equal	0.028 inches.
Inside diameter of steatite	9.90	"	"	0.390 "
Outside diameter of steatite	19.05	"	"	0.750 "
Diameter of inside of metal cone at top	23.62	"	"	0.930 "
Chimney length	152.40	"	"	6.000 "
" inside diameter	38.10	"	"	1.500 "
Height of cut-off	54.61	"	"	2.150 "

The center of the flame to be immediately over the terminal of the photometer bar.

the steatite, and caused to impinge upon the flame by an inner metal perforated and incurved cone, the top of which is level with the top of the steatite; (3) an outer current rising on the outside of the above cone, and between that cone and the glass chimney. The inner perforated cone is punctured with 10 apertures 0.25 inch in diameter, which are



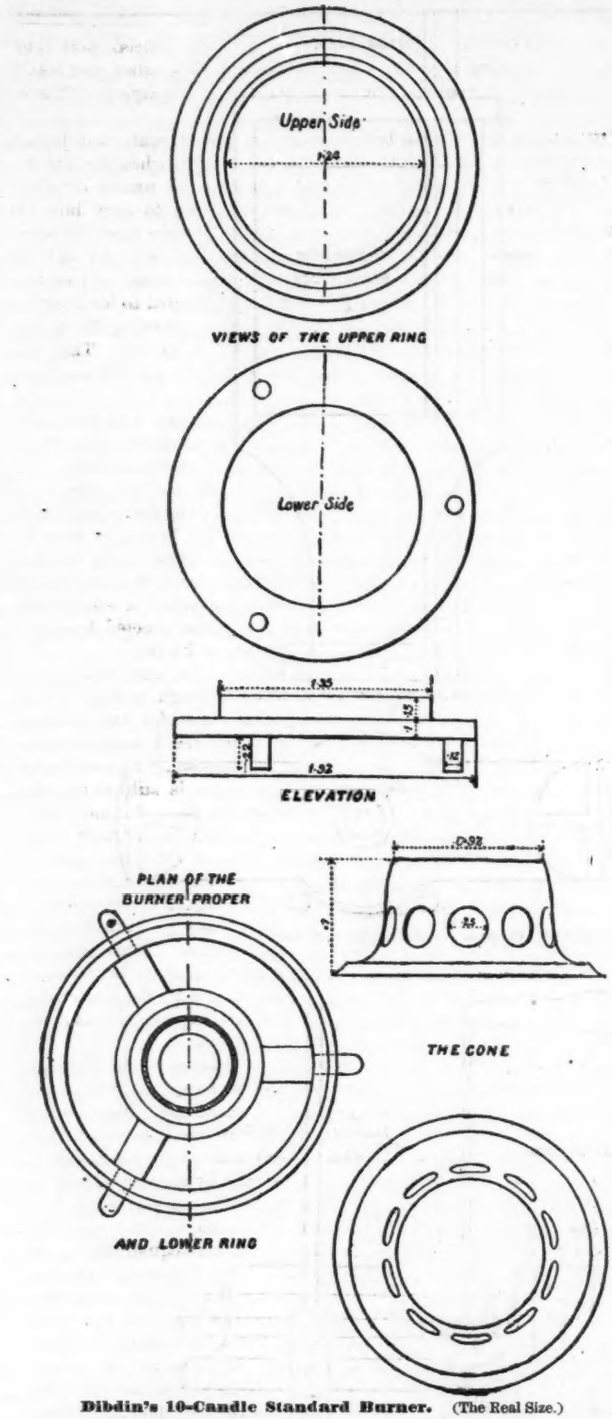
Framing and Screen of Dibdin's 10-Candle Standard Burner. (One-Half the Real Size.)



Dibdin's 10-Candle Standard Burner. (The Real Size.)

provided for the purpose of equalizing the two outer currents of air as may be required to suit the height of the flame.

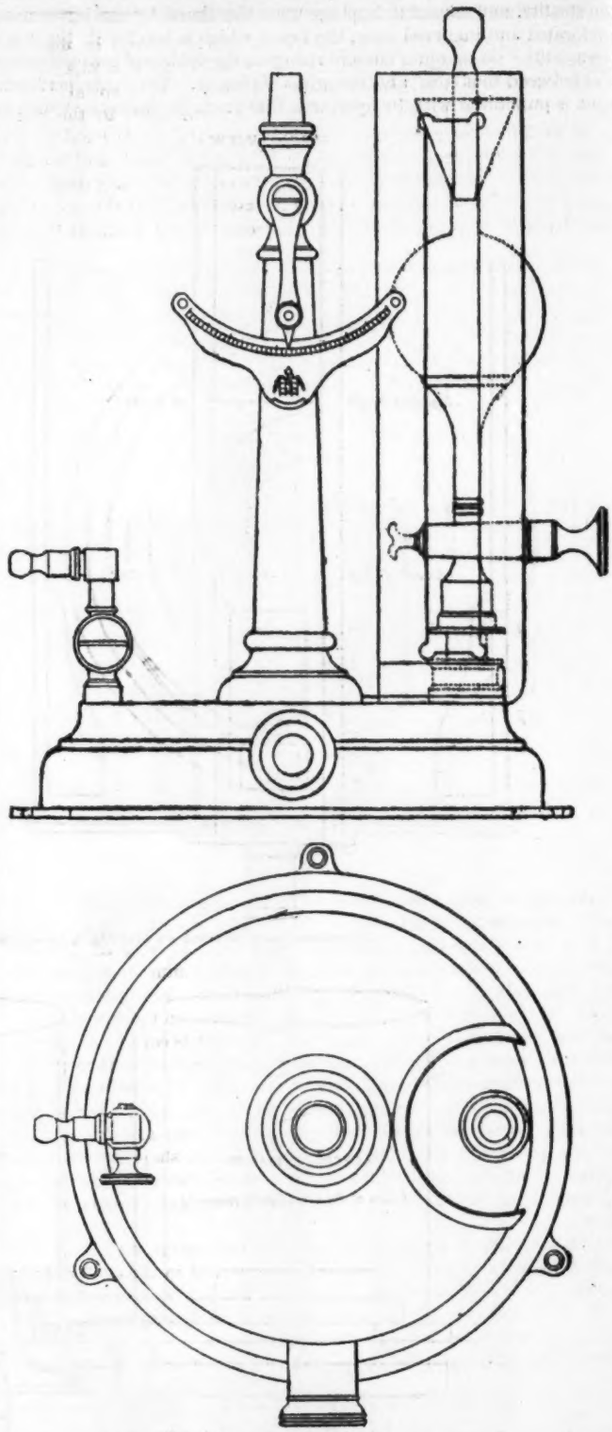
The glass chimney is carried in the groove provided on the outer cone, which answers the purpose of a gallery; the dimensions of the chimney being 6 inches high and 1¼ inches inside diameter. The top of the flame should be maintained as nearly as possible at 3 inches above the steatite; this point being indicated by the wires crossing the blue glass screens carried on each side of the burner on the metal supports. The flame is



Dibdin's 10-Candle Standard Burner. (The Real Size.)

steadied by the small air-directing cone situated centrally beneath the steatite; the apex being 0.03 inch below the metal support carrying the steatite.

On the side of the burner to be presented to the photometer disc, a metal screen, 8½ inches in height, is placed and screwed securely to the base-plate. The middle portion of this screen is cut away, so as to leave above the top of the steatite burner an opening 2.15 inches in height and 1.4 inches in width; the lower portion of this opening being exactly level with the top of the steatite. The light emitted horizontally through this opening by the flame produced by the combustion of the gaseous mixture of atmospheric air and pentane formed in the carburetor described below is used as the standard of light. It is equal to the light emitted by 10 parliamentary sperm candles. The lower portion of the screen has an opening 1 inch wide by 2.3 inches in height, to allow free access of air to the under portion of the burner.



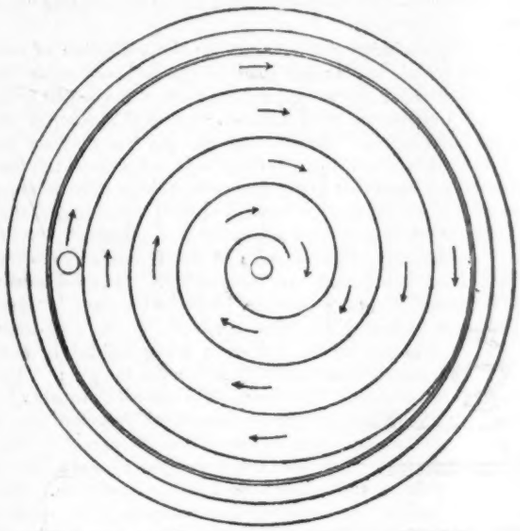
Carburetor for Use with Dibdin's 10-Candle Standard Burner.
(One-Third the Real Size.)

The various dimensions and arrangements of the parts are more particularly described in the above table of measurements and accompanying detailed plans.

The position of the burner in relation to the photometer disc is to be fixed by the burner fitting gas-tight into a faced joint attached to the photometer at the required point; and the burner is to be set at such a height that the center of the illuminated disc and the bottom edge of the cut-off shall be in the same horizontal plane. The length of the connection between the burner and carburetor may be varied, but should not be more than 5 feet. The center of the flame is to be immediately over the terminal point of the photometer bar.

The carburetor for the 10-candle pentane Argand consists of a circu-

lar vessel constructed of tinned plate, 203.2 mm. (8 inches) in diameter and 50.8 mm. (2 inches) in depth, having a spiral division 25.4 mm. (1 inch) in width. This division is made by soldering in a spiral strip of metal, 4 ft. 6 in. in length and 2 inches wide, gas-tight, to the under side of the top of the carburetor; so that, when the top is fixed on, the bottom of the strip comes close to the bottom of the vessel, and is sealed by the pentane, so that the air has to pass over pentane for a distance of about 4 ft. 6 in., and becomes thoroughly saturated. At the end of the spiral division, near the side of the carburetor, a bird fountain is fixed



PLAN OF SPIRAL CHANNEL

(One-Third the Real Size.)

for charging the carburetor, and keeping it charged at a constant level with liquid pentane. The lower end of the inlet fountain tube is closed and rests upon the bottom of the tank. Through the side of the tube, which is 0.4 inch (10.1 mm.) in diameter, 16 holes 1 mm. in diameter are bored close to the bottom, and through these the pentane enters the carburetor. At one side of the inlet tube, 1 inch from the lower end, a small tube 3 mm. in diameter and 20 mm. in length is connected thereto, and turned upwards. The fountain inlet tube is carried up through the top of the carburetor, and continued in the form of a bulb having a capacity of about 200 c.c. Stopcocks are provided at the top and bottom of the bulb, for convenience in filling with pentane; and the portion above the upper stopcock is opened out in a funnel shape for the same purpose. When the carburetor is being charged, the gas must be extinguished, to avoid the risk of the vapor firing and causing an explosion.

The inlet for gas or air is at the side of the carburetor, and at one terminal of the spiral division; the outlet being placed in the center of the vessel, so that the air or gas may travel over the liquid pentane throughout the whole length of the spiral division, and thus become fully charged with the volatile vapor of the pentane.

When using this standard, the pentane must be visible in the fountain bulb.

Inaugural Address by President Robert Mitchell Before the Thirty-second Annual General Meeting of the Incorporated Gas Institute.

Gentlemen: When you elected me your President I was unfortunately unable to thank you in person, but, though delayed, my thanks are none the less sincere. In appointing me President of the Incorporated Gas Institute you conferred upon me a very high honor indeed, and for that honor I now return you my grateful thanks. The discharge of the duties appertaining to the office has been a great pleasure to me, and now that my tenure of office is almost at its close I would venture to hope that I have discharged those duties to your satisfaction. I have at least done my best to earn your approval, and in that endeavor I have had the hearty co operation of every member of your Council.

After the words of welcome that have been addressed to you by the Lord Provost, I need say but one word by way of personal welcome to the capital of Scotland. I hope your visit will be beneficial, both intellectually and physically, and that you will be able, when you return to your respective spheres of labor, to qualify that old saying, "There's no place like home."

Though the Institute has been in existence for 32 years, this is only its second visit to Edinburgh. The first was in 1873, when the late Mr. Angus Croll was President. Without recalling the names of all of those who have "gone before," it may be interesting to note how the Institute has progressed since that time. In 1873 there were 489 members of all classes. In 1888, the year preceding what we may call the "disruption"—seeing that we are in Scotland—the number of members was 823. At the end of last year the number amounted to 583; and if all nominated at this meeting are elected, after allowing for the deceases and removals, the membership will be about 625. These figures, I think, prove two things—viz., that both the gas industry and the Gas Institute are flourishing.

Many who were members in 1873 are, alas, no longer with us; but it must be a satisfaction to all to know that one gentleman who contributed a paper 22 years ago is to contribute another at this meeting. In 1873 Mr. William Sugg read a paper on "Standard Gas Burners," and now he is to give us another on "Photometry as Applied to the Verification of the Illuminating Power of Gas Supplied to Towns." Another gentleman who contributed to our proceedings in 1873 was Dr. Stevenson Macadam; and although we have not the pleasure of his assistance to-day, we have in his son—Professor Ivison Macadam—a worthy representative. Both Dr. Macadam and Mr. Sugg were elected honorary members of the Institute on the occasion to which I refer.

But I must not longer dwell upon the events of a quarter of a century ago. We have a long programme to get through, and as it is not my desire that anyone who has prepared a paper for this meeting should be relegated to the obscurity of an appendix, I have no intention of occupying much of the time at our disposal. A presidential address is an *ex parte* statement, while a paper is subject to cross-examination; and, for that reason, I consider the paper the more valuable of the two. I shall therefore endeavor to make the *ex parte* statement as brief as possible, so that the authors of the papers and the cross-examiners may have plenty of time to discuss the various questions that are to be raised. I would very much regret if any prolixity on my part should be the cause of any one of the ten papers on the *agenda* being relegated to the "taken as read" class. When a gentleman has prepared a communication, the least we can do is to insure a hearing and a discussion; and if that discussion is severe, the author will be consoled by the reflection that the severer the criticism, the greater the benefit both to himself and to the gas industry.

I have touched briefly on a portion of the history of the Institute which is far remote; and I am sure you will bear with me while I refer for a moment to events less distant and more sad. Since we last met we have suffered a great loss by the death of one of our Past-Presidents, Mr. George Garnett. To him the Institute owes a deep debt of gratitude—a debt which we can now repay only by keeping his memory ever green in our hearts. For those of us who worked along with Mr. Garnett in the cause of the Institute, his death means a personal loss, as it does to all who had the pleasure of his acquaintance. He was a man whose integrity was only equaled by his thoroughness and his benevolence. He thought evil of no man. What he said he meant; and what he did he did with a whole-heartedness that recognized no obstacle. In Mr. Garnett the Institute has lost a man whom the whole industry delighted to honor. Among others, we have also to mourn the loss of Mr. Thomas Hardick, who, I believe, was the oldest gas manager in the Kingdom. Mr. Garnett joined the Institute in 1864, and Mr. Hardick two years later.

It is the uncomfortable duty of the President of an Association such as this to say something about the material and technical progress of the industry which we represent; but to mention anything that is new and fresh is becoming more and more difficult as the years roll on, and for two reasons. To adopt a well-known "bull," there is nothing new to say, and what there is has been said before. We cannot admit for a moment that our industry has arrived at the stagnation of perfection, but our progress toward perfection is at the slow rate which betokens a present very high efficiency. The advancement being made in the technics of gas manufacture and distribution is a progress not by "leaps and bounds," but by inches. Nevertheless, I venture to think that the advance is none the less sure. Still, it is impossible for one to select a single year, and say definitely that this or that advance was made in that particular year. In this country we have a very expressive saying, so apt that it may not be unintelligible to my English auditors. It is that "every little maks a muckle." That, as I conceive it, is the

position of the gas industry at the present day. A little improvement is made here and another there, and one day we waken up and find that a great achievement has been attained. The action is more of a silting than of a volcanic character. Take, for instance, the developments in charging retorts. We had first the shovel, next the scoop, then the hand machine, and finally those beautiful appliances which have been the outcome of the genius of West, Foulis and Arrol. But these changes were not brought about in a day or a year. The final achievement, if I may be permitted to use the term in connection with a subject that is ever progressing, was the outcome of accumulated experience and years of patient labor and study. To the younger members of our Institute this should be a lesson and an encouragement. Young men are apt to think that, if they are not "setting the Thames on fire," they are doing nothing worth the doing. The sooner they get rid of that idea the better for themselves and for the industry which, by and by, must be committed to their care. What is commonly called genius is frequently little more than luck. True genius consists of an infinite capacity for labor—labor that may appear plodding and fruitless at the moment, but which, if properly applied and directed, will inevitably bear sound fruit in the end, to the advantage both of the laborer and the cause in which he labors.

That there is a wide field to work in there can be no doubt. Perhaps we do not always realize what a vast amount of capital and what an army of laborers are employed in the gas industry in one way or another. We all know that the capital invested in "authorized" gas undertakings—undertakings belonging to companies and municipalities, and which are regulated by special Acts of Parliament—is something like £68,000,000; and that the quantity of coal that these bodies annually carbonize is about 11,000,000 tons. But it must not be hastily assumed that this is a true measure of the extent of the industry. It is far from it. The "authorized" undertakings in Scotland number only 37. But the returns prepared annually by the Committee of the North British Association of Gas Managers show that the total number is 244. Similar figures are not available for the other divisions of the United Kingdom; but I believe that if they were, they would indicate a like disproportion. No doubt the undertakings that do not appear in the "authorized" returns are mostly small works. But, as I have said, "every little maks a muckle," and all these little works go to swell the bulk of business done.

If we take 12,000,000 tons as the quantity of coal annually carbonized in gas works in this country, it will be a nearer approach to the actuality than is given by the "authorized" returns. In the actual work of carbonizing that quantity, there are employed between 55,000 and 60,000 men; and that is taking no account of the managerial and clerical staffs, and the army of men who find employment in the winning and transport of the coal and in the treatment of the residuals that are produced in the gas works. These few figures, which are, of course, simply estimates, may serve to give a more correct idea of the magnitude of the industry in which we are engaged. But over and above that, there is the capital and likewise labor employed by the numerous firms whose business it is to supply gas works with the hundred and one things—from a bolt to a gasholder—that are necessary to the full equipment of the modern gas works. The extent of that we can only guess at.

Speaking of the quantity of coal used in gas works reminds me that two processes of gas manufacture, having for their object the reduction of that quantity, have been engaging much attention during the past year. I refer to the water and oil gas processes; and it is matter for regret to me that not one of our members has seen his way clear to supply us on this occasion with a paper on either of these systems. I had hoped to be in a position to give you my own experience in the working of both methods; but, unfortunately, my Commissioners have not decided as yet to introduce either at the works under my charge. But I have had opportunities of inspecting the working of the Lowe water gas plant, both in this country and in America, and what I have seen of it has led me to the conclusion that, sooner or later, some such process will be adopted in most large works as an auxiliary, and that it will be a factor of no small importance in reducing the cost of production of the finished article. It has now been pretty clearly established that a 22 to 24-candle gas can, by this process, be delivered into the holder at a cost of between 1s. 1d. and 1s. 3d. per 1,000 cubic feet—a price which will make it, in many cases, cheaper than coal gas of the same quality, with the further advantage that it offers a means of disposing of that surplus coke which so often cumbers the yards of many gas works. In particularly referring to the Lowe process I do not mean to suggest that the same advantages cannot be derived from other water gas patents. No doubt they can; but, having personally examined the Lowe process, I can speak of it with some degree of certainty. Hitherto it has not been considered advisable or economical to manufacture carbureted water gas in bulk. It has only been made in sufficient quantity to raise the illuminating power of the coal gas to the standard demanded by statutory authority or by usage. I am inclined to believe that this is its proper place—at the present time, at all events; and, if rumor be correct, the Board of Trade officials appear to be of the same opinion. But I cannot altogether agree with the reasons which are said to have led these gentlemen to that opinion. They seem to think that if water gas is allowed to be supplied in quantity the whole gas-consuming public will shortly be classed in the rental book under the heading "Gone—no address."

While fully appreciating this concern for the collection of our accounts, I think a little too much is made of the carbonic oxide bogey. The opponents of water gas have made the most of the deaths from gas poisoning that are reported from America; but in this country we are not so much addicted to "blowing out the gas" as they are in the States. From the last report of the Gas Commissioners of the State of Massachusetts, we learn that in the year 1893–4 there were reported 32 fatal cases of gas poisoning. Of these, five were "undoubted cases of suicide," and six others had "the appearance of suicide;" leaving 21 as "clearly accidental." The remarks of the Commissioners on the cases returned as "accidental" are interesting. "Retired somewhat under the influence of liquor—probably blew out the gas;" "Gas was escaping through a 10-foot tip from a fixture on the wall over the bed;" "The gas was not in use, the room being lighted by electricity;" "Winifred, aged 16, had probably blown out the gas;" "Gas escaping from a broken pipe;" "Fixture partly opened—probably left so by accident;" "Possibly overcome by an epileptic fit before he could light the gas;" "Gas escaping from one of the burners;" "The gas jets were turned down;" "Gas jets turned partly on;" and so on—most of the cases being due to taps being turned full or partly on. The returns as to the "makes" are not altogether complete; but apparently the year's make was about 4,400 million cubic feet, and 2,000 million cubic feet of that was water gas, equal to about 46 per cent. of the total. But we cannot attribute these 27 deaths to the presence of the 46 per cent. of water gas, for with coal gas the result would have been the same. Rather must they be laid to the account of individual carelessness and to the common use of bad taps—taps unprovided with a stop to limit their movements. If the fittings are sound, as they ought to be, there should be no more danger from carbureted water gas than there is from coal gas; and that, in the absence of culpable negligence, is *nil*.

My reason for believing that carbureted water gas will be used only as an auxiliary and enricher is that market considerations are bound to come in, and so balance the cost of the two kinds of gas that neither can ever hope to have much of an advantage over the other.

In speaking of the safe supply of carbureted water gas, I took occasion to remark that the fittings must be sound. Unfortunately, these are beyond the control of the gas supplier. It has always been a cause for wonder to me that the present haphazard system of gas supply has prevailed so long. It is frequently said that we provide *light* and not *gas*. But it appears to me that, under the existing system, we do not get a fair chance to supply either the one or the other; for it frequently happens that when the pipes are ample to convey the gas, the burners are not capable of developing the light, and when the burners are capable, the pipes are not. Only recently a case came under my notice where a half-inch pipe was expected to supply 100 burners! In these circumstances, the wonder is—not that there are complaints of "bad gas," but that those complaints are so few. Most water-supplying undertakings will not turn on the water to a house until they have satisfied themselves that the pipes and taps are in accordance with specifications; but the unfortunate gas supplier is compelled to send his gas, on application, into what to him is a *terra incognita*. If the pipes are properly proportioned, and the burners good, he gets credit for manufacturing good gas; while next door, where the conditions are reversed, he is charged with supplying air or, it may be, that the charge is that he refuses to supply anything.

In these days of portable photometers and amateur testing, surely it is not too much for the gas supplier to ask that he should be assured of the gas he sends out being tested under something approaching proper conditions. As it is, we are held responsible for what we have no control over. I would not go so far as to say that pipes and burners should be at all times open to the inspection of the gas manufacturer; but what I do suggest is that, before the gas company can be compelled to give a supply, they ought to have the power to demand that the service pipes and the burners are such as will enable the best use to be made of the

commodity. In the absence of compulsory powers, much might be achieved if architects and gasfitters would more frequently seek advice on these matters from the responsible officials of the gas companies. The distribution of gas is a special trade in itself; and those who make it their special study, ought to be consulted more freely than is at present the custom.

The system adopted in connection with the incandescent gas light, or some modification of it, might with advantage be applied to gas lighting generally. The Incandescent Gas Light Company not only sell burners, but they undertake to fit them up, and to give them all the attention they require from time to time. It may be thought that, were the gas companies to do this, they would be overstepping the limits of their duties; but I am rather doubtful about that. We are *light*, not *gas* suppliers, and the pipe and the burner are parts of the apparatus required to produce luminosity. The incandescent system gives a very beautiful light, and one that has been highly appreciated, both in public and private lighting; but I venture to think that a part at least of its popularity may be traced to the scientific care which has been devoted to its practical application. "Anybody can fit up an ordinary burner," it is said; "but it wants a skilled man to fit up an incandescent burner." That is just where a great mistake is made. The ordinary burner has its laws, as well as the incandescent; and if these are not respected, disappointment is the result.

During your visit, you may have opportunities of contrasting the incandescent gas burner and the electric light. The principal thoroughfares of the city are now lighted by arc lamps; and if you walk across to Nicolson Square, you will find an example of street lighting by Welsbach lamps. Through the courtesy of Mr. Monkhouse, the Resident Engineer, the electric light station, which is considered to be *par excellence*, will be open for the inspection of the members on Thursday afternoon. The works have been in operation since the middle of April last; but they do not seem to have appreciably affected the consumption of gas. During the laying of the electric culverts, much inconvenience and trouble were experienced in connection with the gas mains and services, and several explosions occurred—happily unattended by serious consequences. Precautions have been taken to prevent further accidents; and at present I am engaged experimenting with a gas detector, with a view to making things absolutely safe. Meanwhile the plan has been adopted of plugging the ends of the conduit at each box, so that the area of possible danger is restricted—a system that has recently been recommended by the Board of Trade.

To my mind, this is a great improvement upon conduits open from end to end, and with nothing in the way of ventilation beyond what accident provides. But possibly a still better plan would be that suggested by one of our members, Mr. Foulger, on the occasion of the official inquiry into the Cannon street accident. You will remember that Mr. Foulger's proposal was that the electric light standard should be utilized as ventilating shafts. The lower half of the standard was to be packed in earth, to prevent fire-back from the arc; and a small ventilating pipe was to be carried from the culvert up through the standard to about half the height of the latter, where it would open to the atmosphere. The variations in level that are to be found in most cities would provide the necessary current; and the open ends of the ventilating pipes would be beyond the reach of mischievous boys and "safety" matches. But my experience of the electric light, as a neighbor, has been too short to enable me to speak with any authority upon this important subject. Perhaps its final settlement may be delayed till a gas director and an electric light director are blown up together; but if that is to be so, I am sure every one of us will delay the settlement as long as we possibly can.

To-morrow we are promised a lecture from our esteemed friend Prof. Lewes upon what may be justly entitled the novelty of the year—"acetylene gas." I shall not attempt to forecast what Professor Lewes has to say; for though he has spoken upon this subject about half-a-dozen times in as many months, he is such a rapid worker that he has always something new to lay before his audience. By his last deliverance upon acetylene, he put it out of the region of the gas manager's practice. It appears that acetylene is very fine by itself, but that it "sulks" when it gets into company. Why it conducts itself thus Professor Lewes will, no doubt, explain. At present the position appears to be that acetylene, with an intrinsic illuminating power of 240 candles—I beg Mr. Lewis T. Wright's pardon for using the word "intrinsic"—with a photometric value of 240 candles, has little more enriching effect than oil gas with a photometric value of 60 candles. As I have already said. I am unable to give you any personal experiences of oil gas, and it is difficult, from mere inquiry and inspection, to form a sound judgment as to the several processes now claiming the attention of the gas profession. The only method that I have at all studied is the "Peebles" process; and I am sure, apart altogether from our individual opinions of that plant, we heartily welcome its chief author to a place in our ranks. Regarding the system itself, the accounts given by those who have worked it are in every instance highly favorable. In its original form, it has done good work as an enricher; and a further development promises to bring it into the market as a bulk producer.

Both the chemical engineer and the mechanical engineer are working for the benefit of the industry. The former devises and perfects water and oil gas processes; and the latter gives us coal breaking, conveying, charging and drawing machinery, as well as sloping and rotary retorts. Rotary retorts have not progressed beyond the experimental stage; but the merits of sloping retorts and machinery for horizontal retorts may, I think, now be considered as proved. As to which is the better, I shall not venture an opinion at present. As yet, I have not personally experimented with either; but we are now engaged in putting in charging and drawing machinery of the Arrol-Foulis type at the works under my charge.

With regard to gasholders, which are important factors in the equipment of gas works, each succeeding one appears to be bigger than its predecessor. In a very short time we shall have in Scotland the largest holder in the world outside London. The economy of the large holder is beyond dispute; and there appears to be no reason why even the mammoth of the South Metropolitan Company should not yet be superseded. It will be perfectly evident to everyone that much greater saving can be effected by storing say 12 million cubic feet in a single holder than by using three or more separate holders for the same purpose.

But to put the gas into the holder is not the only duty of the present day gas manager. He has also to take it out and sell it. We are to be favored with a paper on "Distributing and Districting," so I shall not take up your time with that subject, though Edinburgh is a fine example of the necessity for districting. But to that I may have an opportunity of referring when Mr. Cross reads his paper. Beyond the distribution of gas through the mains, the manager of to-day has to attend to the provision for gas fires and cookers—a part of his duties to which he cannot devote too much attention. Here he has more scope for his energies than in the supply to burners; for when, as is generally the case, the fire or stove is let by the company or committee, he has some control over the service pipe. The rapid development of this branch of our business must be a source of satisfaction to us all, as must also be the rapid displacement of the dangerous oil lamp by the safe and convenient "penny-in-the-slot" gas meter.

The legislation of the past year has been comparatively uneventful, as far as the gas industry is concerned. The South Metropolitan Gas Company promoted a bill which attracted a good deal of attention—not on account of what it contained but on account of what it omitted. The bill, as it appeared before the House of Commons, was simply one for the conversion of the nominal 10 per cent. stock of the Company into a nominal 5 per cent. stock—a proposal not by any means novel. Parliament has on several occasions recognized the principle; but in this instance the committee reported that "they considered the subject was one of such far-reaching importance that the question of conversion of stocks ought to be dealt with by a committee specially appointed to consider the same as affecting gas and water companies." As the conversion of the stock was the backbone of the bill, the promoters declined to proceed further. When the bill was first drafted, it contained clauses giving the Company's workmen shareholders special privileges in the way of electing one of their number to the Board of Directors; but these clauses never came before Parliament, for reasons that are, no doubt, known to you all. That it was wise to withdraw them, I cannot doubt. It is almost impossible to imagine that matters would work smoothly with a man in the retort house five days in the week, and in the board room on the sixth. Mr. M'Crae has promised us a paper on the treatment and remuneration of workmen, and that it will give you an opportunity to express your individual opinions upon this very important subject.

To those of us who do not believe that a low quality gas is the panacea for all ills, the announcement recently made, that no gas bill would be allowed to pass with a less standard illuminating power than 15 candles, must have been very pleasing. The substance of the argument advanced in favor of a low illuminating power seems to be that, because the public do not know how to use a good thing, they should be supplied with a bad. But to my mind, it would be infinitely more reasonable were we to devote ourselves to educating our customers up to the use of the better article. That there is no immediate intention of reducing the standard illuminating power is indicated by the fact that

the Committee on Standards of Light, after an inquiry extending over three years, has recommended that London gas be tested at a rate of consumption to give a light of 16 candles. The Committee also recommended that the standard candle be discontinued, and that the 1-candle pentane air flame takes its place—a proposal to which I do not suppose there will be any serious objection. Indeed, it is practically what this Institute recommended should be done.

In litigation, which is a near kinsman of legislation, I may mention the Gourock gasholder case, as the first that has come under the Burghs (Scotland) Gas Supply Amendment Act. In this case it was sought to prevent the erection of a gasholder upon a certain site, on the ground that its presence would depreciate the value of the surrounding property; but, after a careful hearing, the Sheriff decided that the sanction of the neighboring owners could be dispensed with. It is of little importance in itself, but it establishes a valuable precedent.

I am afraid I have already wearied you, but before I sit down I would beg to say just one word upon a subject which I consider of great concern to this Institute. Many of you will have noticed from the report of the Committee of Management of the Benevolent Fund that, during last year, the income has not been equal to the expenditure. May I venture to express the hope that this will prove an exceptional report? The Benevolent Fund does a great deal of good work in an unostentatious way, and it is deserving of the support of every member of the Institute.

In conclusion, gentlemen, I thank you for the patient hearing you have accorded to me whilst I have reviewed the various topics of interest at present occupying the minds of gas managers and others engaged in the profession. I will not detain you further, but proceed with the business before us.

Pearson's Improved Means for Supplying Oil to Superheaters.

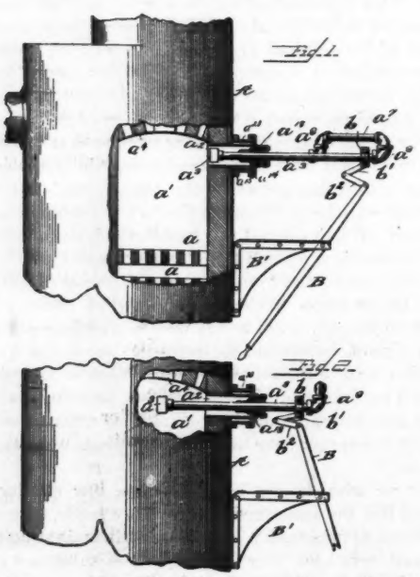
On June 18th U. S. Letters Patent (No. 541,116) were granted to Mr. Wm. H. Pearson, Jr., of Toronto, Canada, for an improved method of supplying oil to superheaters in gas making apparatus. The inventor subsequently assigned his claim to the Economical Gas Apparatus Construction Company, of Toronto.

Using the words of the specification:

The main object of the invention is to shift the oil spraying device so that it will be out of the way of the products of combustion while the superheater is being heated and to bring it into its proper position when it is desired to carburet the water gas passed through the superheater between the heats.

Other and minor objects will hereinafter be set forth.

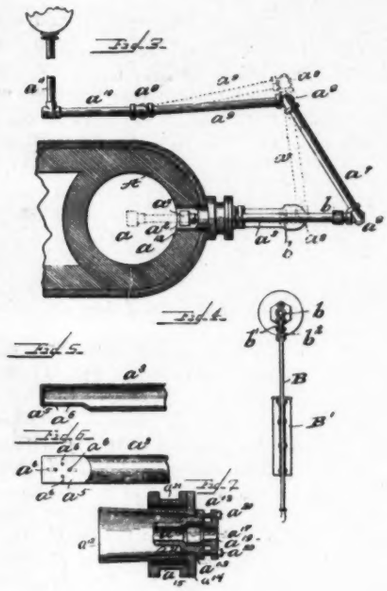
The invention consists of the construction and combination, as will



hereinafter be set forth in the specification and pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 represents a superheater with parts broken away to show the interior and my improved device attached thereto; Fig. 2, a similar view showing the improved device in a different position from that shown in Fig. 1; Fig. 3, a section of the superheater and a plan of the oil-supplying device; Fig. 4, an end elevation showing the arrangement of the levers; Fig. 5, a section of the preferred form of sprayer; Fig. 6, a bottom plan of the same; Fig. 7, a section on an enlarged scale of the thimble and other parts connected therewith.

A represents the superheater or mixing chamber, which may be of any of the well known types. The interior is provided with the usual



checkerwork a, which is arranged so as to leave a mixing chamber a^1 at a certain point or points in the superheater. In the wall of the superheater is an opening a^2 of any suitable size or shape, for the insertion of the spraying nozzle a^3, of any desired construction, into chamber a^1. This nozzle is inserted through opening a until it is in the axial center of chamber a^1, and preferably near the arch a^4 so that when the oil is sprayed into the chamber it will be delivered into the middle of the current of incoming water gas and carburet the same with oil. The advantage of this construction over the old form of delivering the oil into the superheater is manifest, when it is recalled that the oil is ordinarily projected from the side of the chamber at an angle to the course of the current of gas through the superheater, thereby giving to some parts of the current too much oil and forming tarry globules on the checkerwork above it and not a sufficient quantity to the other parts of the currents to properly carburet it. By projecting the oil into the center of the current this objection is removed, and especially so when a spraying nozzle having the spraying openings so arranged that the oils ejected therefrom meet at a predetermined point and break one another up into a fine spray. Such a nozzle is shown in Figs. 5 and 6, and consists of a pipe or tube having the flattened face a^5 provided with openings a^6 arranged obliquely on lines having a common center or force below the outlet ends of the tube so that the jets of oil forced out of the openings will strike one another and scatter themselves in a fine spray against the upcoming current of water gas.

The nozzle a^3 is preferably cylindrical in shape and projects outside of the superheater to any desired distance, and is connected to another pipe a^7 by a swiveled joint a^8. The pipe a^7 projects at an angle and sidewise to nozzle a^3, and it in turn is connected with pipe a^9 by a similar joint a^8. The pipe a^9 is connected by a joint a^8 to a pipe a^{10} that is parallel to the nozzle a^3, but to the rear and to one side thereof. The pipe a^{10} is connected with a suitable oil-supplying device a^{11} located at any desired point. By this arrangement of pipes the spraying end of the nozzle can be moved in and out of the chamber a^1 without any strain upon the parts and without the necessity of disconnecting any of the parts thereof.

The opening a^2 is provided with a flaring thimble a^{12} imbedded in the wall of the superheater with the flaring mouth opening into chamber a^1. The smaller or rear end is provided with a screw-threaded opening a^{13} and a flange a^{14} between which and the wall of the superheater is interposed a flanged ring a^{15} that is secured to the flange a^{14} and forms a dead air space a^{21} between the thimble and ring. In the screw-threaded opening a^{13} is screwed a sleeve a^{16} for the nozzle a^3 to slide in when

moved back and forth for the purposes mentioned. The rear end of the sleeve a^{16} is enlarged to form a chamber a^{17} in which is placed packing a^{18} held in place by the gland a^{19} secured to the sleeve a^{16} by means of bolts or other retaining devices a^{20}. When properly packed the nozzle a^3 can be moved back and forth without the gas escaping. Any tendency of the nozzle when pulled out, to draw the thimble out of the opening a^8, is resisted by the flaring mouth, and any tendency to force the thimble into chamber a^1 when the nozzle is pushed into position in said chamber, is resisted by the ring a^{15}.

Any desired means for drawing the nozzle in and out of chamber a^1 may be used, but I prefer the device shown. In that device a lever B is fulcrumed upon a bracket B^1 secured to any desired place, preferably the wall of the superheater, and is connected by one end to the nozzle by means of a clip b which embraces said nozzle as shown, and links b^1 and b^2 that break the end of the lever B and thereby prevent any bending strain upon the nozzle by the lever when used to move the nozzle in and out. What I claim as new is:

1. The combination of a superheater having an opening in its wall, a nozzle adapted to be moved in and out of the superheater through said opening in a straight horizontal line, and an oil-supplying device connected with said nozzle by pipes jointed together with swiveled couplings which permits of said nozzle being moved in and out of said superheater.

2. The combination of a superheater having an opening in its wall, a stuffing box in said opening, and having a center opening and nozzle adapted to be moved in and out of the superheater on a straight horizontal line through the opening in the stuffing box, and an oil supplying device connected with said nozzle by pipes jointed together with swiveled couplings which permit of said nozzle being moved in and out of said superheater.

3. The combination of a superheater having an opening in its wall, a thimble in said opening, and flared from the outer to the inner side and connected with the outer side of the wall of the superheater, a stuffing box having a central opening and screwed into the outer end of the thimble, a nozzle in said opening of the stuffing box, and means for moving said nozzle in said stuffing box to reciprocate the nozzle back and forth in a horizontal line.

4. The combination of a superheater having an opening in its wall, a thimble in said opening, and flared from the outer to the inner side and connected with the outer side of the wall of the superheater, a stuffing box having a central opening and screwed into the outer end of the thimble, a nozzle in said opening of the stuffing box, and a lever connected with said nozzle by links so as to reciprocate the noxzle back and forth in a horizontal line.

5. The combination of a superheater having an opening in its wall, a nozzle arranged in said opening and adapted to be moved back and forth therein on the same horizontal line, and a lever connected with said nozzle by links to reciprocate the nozzle back and forth in a horizontal line.

Cost of Horse Power in Buffalo.

Now that the Niagara Falls Power Company is about ready to begin to deliver power, judging so at least from its offer to supply power in Buffalo at a stated price per horse power, the following from an editorial in the *Electrical Engineer* will be of interest to our readers—it must be borne in mind that the argument emanates from a source whose point of view is eminently favorable to all things electric:

The resolve of the American Institute of Electrical Engineers to hold its meeting at Niagara on June 25 again directs attention to the great power transmission enterprise there, about which so many articles have already appeared in our pages. It is a curious anomaly, however, that although the engineers, several hundred strong, are going to the Falls to see this remarkable plant, designed for transmission work, the city of Buffalo, through some strange twist of politics or sentiment, is actually in the position of barring out the power which the plant would deliver to it. Indeed, the situation may be more critical than Buffalonians assume, for apparently as fast as a new generator gets into place a local consumer of the power starts up at Niagara; so that presently we may see the strange spectacle of a great city at the Falls, with Buffalo as an annex in which the motive energy is so much dearer that every consumer who can leaves it in order to get nearer the great cataract. Buffalo may yet be playing to Niagara Falls the part that Brooklyn plays to New York City. A recapitulation of the facts in such an extraordinary situation as the present will not, perhaps, be amiss.

In 1894 the Niagara Falls Power Company applied to the Common Council of the city of Buffalo for a franchise giving them the right to distribute their power in that city. They had already practically secured their right of way from Niagara to Buffalo and had ordered three 5,000-horse power dynamos with a view to transmitting 10,000-horse power of their product for use in the city of Buffalo. Subsequently and quickly, a large portion of the product of these dynamos was leased by the company for local use on their lands at Niagara. To supply 10,000-horse power to Buffalo now would require an extension of the present wheel pit and the installation of three additional 5,000-horse power turbines and three additional 5,000-horse power dynamos. Such additional installation, however, could be made in eight months from the time the order was given, and it would probably take eight months for the city of Buffalo to get ready for the distribution.

On February 21, 1895 (just three months ago), the Power Company, at the request of the Common Council, submitted a statement of their position in regard to power for use in Buffalo. The company remarked that two restrictions incorporated in the proposed franchise would absolutely prevent its acceptance by the company—one of them being a time limit less than the term of its bonds, and the other being the fixing of a maximum or other price for power in the city. In this same statement the company met the suggestion that the city itself purchase the power from Niagara, by offering to sell power to the city in blocks of 10,000-horse power delivered at Niagara, either as "undeveloped" power, "developed" power or "electrical" power, at the low prices of $10, $13 and $18 per horse power per annum respectively. This was to enable the city to exercise entire municipal control of the power in Buffalo. This statement also contained some figures as to the cost of steam power in Buffalo which were obtained from actual expert tests.

Nothing has been heard by the company in reply to this statement—we are informed—and it now appears that after three months' delay the Common Council is about ready to recommend a franchise, the text of which, as printed recently in the Buffalo papers, seems to contain the two restrictions which will absolutely prevent its acceptance by the company if the company stand on their original statement. It contains other restrictions which seem to us both onerous and unreasonable, It is only necessary to mention two of the conditions: One is that the company shall supply the city with electric power for the operation of their water works, requiring 4,000-horse power, at $20 per horse power per annum; and the other is that they shall supply electricity so that the General Electric Company, of Buffalo, who have the contract for municipal street lighting in that city, shall be able to furnish arc lights at $50 per horse power per annum. It must be obvious to any one familiar with the cost of electrical power and electric lighting that these two restrictions amount to compelling the Power Company to give to the city 4,000-horse power for their water works at one-third of the cost of the steam power now operating their city water works plant and at less than the present cost of electrical horse power at Niagara; and, further, to supply to the General Electric Company, of Buffalo, about 3,500 electrical horse power without charge. It is a well known fact that if the mechanical power were given to the Buffalo General Electric Company by the Niagara Falls Power Company free of charge, the local lighting company could not at cost furnish arc lamps at $50 per horse power per annum. The supply of carbons and the attendance alone upon each arc lamp is well known to be about $25 per arc lamp per annum, and an arc lamp is practically equal to a horse power.

These restrictions seem to be absolutely prohibitory, and it must be ignorance on the part of Buffalo's officials which considers for a moment the introduction of such provisions in the franchise. It cannot be supposed for a moment that the city of Buffalo undervalues the advantages of the introduction of Niagara power, about which it has boasted for so many years, and on account of which it has assumed to itself the astounding title of the Electric City.

Recent tests of the cost of steam power in Buffalo, made since the publication of the printed statement of the Power Company—and by so competent an expert as Horatio A. Foster—show that for small plants, such as newspaper and printing plants, where the amount of horse power in use varies from 20 to 150-horse power, the cost of the steam horse power per annum varies from not less than $110 up to as high as $160, while no large plant in the city of Buffalo can be found using 1,000-horse power or more where the cost of the steam power is less than $50 per horse power per annum. It appears, however, that the Power Company are willing to go to the large expenditure necessary to introduce Niagara power in the city of Buffalo. It is certain that the company cannot sell that power unless it can be used at a cost below that of steam power, yet Buffalo does not seem to be willing to have the company at their own cost, free of charge to the city, put Niagara electric power on sale in the city of Buffalo.

Engineering Fallacies.

[By President Henry Morton, Ph.D., in the *Stevens Indicator*.]

In the report of my lecture on Engineering Fallacies, which was published in the *Indicator* of October, 1894, occurs the following remark: "It may seem almost needless to say so much on the subject of these gross and conspicuous fallacies; but, while the stock of the Keely Motor Company, in the face of repeated exposures and years of unfulfilled promises, has to-day a value in the market, and when not only such daily papers as are notorious for their lack of truth, honor or decency, but even respectable journals, will publish articles seriously advocating such plans, it is evident that even such fallacies need to be met and exposed by the intelligent engineer." Since the publication of these words, the necessity of such explanations and exposures of even such gross and conspicuous fallacies has been very emphatically illustrated.

Thus, to begin with, even so respectable a journal as *The Engineer*, published in London, in its issue of January 11th, had an editorial article on my paper above named, in which my conclusions as to the impossibility of "perpetual motion" were called in question, and it was maintained, on the contrary, that the discovery of mechanical and like combinations by means of which power might be got for nothing is a possibility that no one would be justified in denying.

That such a position should be taken, at this date, by the editor of an engineering journal of such standing is so remarkable a phenomenon that I will quote tha language of *The Engineer* on this subject.

After some general remarks on the doctrine of conservation of energy, etc., the writer proceeds to illustrate his position as follows:

"Let it be supposed that the cylinder of a beam engine was removed and replaced by a series of very powerful magnets arranged round the piston. If, now, the first ring of magnets, and then the second and third, and so on, attracted the piston successively, the engine would work just as though driven by steam. Let the magnets be permanent, and let the piston be surrounded by a cylindrical shield, which, while itself non-magnetic, would also cut off the influence of the magnets as it passed each on its way down. Under these conditions we would have a machine which would comply with the perpetual-motion man's desire. In one sense it would flatly contradict the conservation of energy theory—we should get power for nothing. The only thing needed is the magnetic shield. Now why is it that no such shield exists? Is it because the existence of the shield would upset the conservation of energy?"

To the above double question we answer at once, yes. In other words, the law of the conservation of energy is like all other laws of science, simply the generalized statement of universal antecedent experience. If they deserve to be accepted as laws, it is simply because antecedent experience has been so extended and invariable that we are entitled to believe that it will continue to be invariable, and that, therefore, we are warranted in assuming that a statement or assumption which would flatly contradict such laws is untrue or impossible.

It may, of course, be said that our experience can never be so extended as to absolutely exclude the possibility of some modification of any given law; but that simply goes to the question as to truth of the law, and of our reliance upon it.

As long as we believe the law to be true, we must assert of any proposition subverting such law that it is untrue or impossible.

To say that any one can "hold the doctrine of the conservation of energy with unquestioning faith," and yet regard as possible a condition of facts that would "flatly contradict it," is to use language in a manner only appropriate to a lunatic asylum.

Our friend of *The Engineer* is probably not aware that his suggestion about the engine operated by permanent magnets and a magnetic shield is not new.

In 1879 a Mr. Gary brought before the public in Boston, Mass., a magnetic motor, which was represented as operating in just this way. A magnetic shield was interposed between permanent magnets and movable pieces of soft iron and withdrawn at the proper time, so as to secure continuous motion. A 5-page illustrated article, headed "Gary's Magnetic Motor," treating the subject in all seriousness as involving a great and useful discovery, was published in the long established and highly respected journal, *Harper's Monthly*, in its issue of March, 1879, pp. 601-605, inclusive.

In this article it was truly stated that a plate of soft iron would constitute a magnetic shield, and that, if introduced between a permanent magnet and an armature or piece of soft iron attracted by said magnet, it would cut off such attraction, which would of course be renewed on the removal of the shield. Various forms of motors operating on this principle were figured and described.

The operation of these machines was described at the time, by an eye-witness, to the present writer, who, however, did not find his belief in the conservation of energy consistent with the acceptance of assertions flatly contradictory to the same, even from an eye-witness; but, by a careful examination, elicited the fact that all the machines which ran without manual aid had electro-magnets in them excited by a galvanic battery. The inventor had explained that this was only to secure greater intensity of magnetization than could be obtained with permanent magnets; but the opening for fraud thus presented was of course manifest. In the machines not operated with electro-magnets the withdrawal of the magnetic shield was effected by hand.

The whole matter was not difficult to treat on general principles. It is, of course, true that iron will act as a "magnetic shield;" but when it does so, it is itself attracted, and the work expended in withdrawing it from before the magnet, as might reasonably be expected, is equal to that which could be developed by the changes of attraction secured by its manipulation.

In this case, the condition required by the *Engineer*, of a magnetic shield not itself magnetic, was not supplied, neither has such a shield been produced since, nor need it be expected that such a combination will ever be discovered. If it should be, perpetual motion would be realized, and "the conservation of energy" would become an exploded theory.

It is interesting to notice that the fundamental principles involved in the actions which really took place in the Gary motors are fully expressed in "Rudimentary Magnetism," by Sir W. Snow Harris, published in the *Weals Series of Manuals*, 1850, pp. 29 to 36.

Indeed, we find the foundation of it all in the "Principia" of Sir Isaac Newton, Proposition XXIII., Theorem XVIII., Scholium, where we read: "We have an example of this in magnetic bodies. Their attractive virtue is terminated nearly in bodies of their own kind that are next them. The virtue of the magnet is contracted *by the interposition of an iron plate*, and is almost terminated at it."

It is hardly necessary to say that the Gary Magnetic Motor turned out to be a fraud, the energy required for the automatic motors being supplied by the galvanic battery whose connections with the electro-magnets were broken at the proper time, while, in the others, the manual force applied to the shields was in fact the origin of their movement.[1]

Again, our friend of the *Engineer* says, "Thus, there is no reason known to mankind why gravity should not be interrupted; and, if any inventor announced to-morrow that he had discovered or invented the material, no man living would be justified in calling him a liar, on the ground that he said he had done that which is impossible."

To this I would reply that any man who "held the doctrine of conservation of energy with an unquestioning faith" would be fully justified in using any terms consistent with propriety, in indicating his absolute disbelief in the statement made, because the same "would flatly contradict the conservation of energy," and would therefore involve a claim that "he had done that which is impossible."

There *is* a "reason known to man why gravity should not be interrupted," namely, that such a performance would flatly contradict the doctrine of the conservation of energy, and also be contrary to universal experience; and, therefore, when I see the performances of illusionists, or read of those by Indian fakirs, in which gravity seems to be interrupted, I do not trouble myself in the least as to the ground of my faith in "the conservation of energy," but simply try to detect the trick.

[To be Concluded.]

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

EDINBURGH, June 14, 1895.

Report of the Photometric Standard Committee.—The Gas Institute at Edinburgh.

The Committee appointed by the Board of Trade more than three years ago, for the purpose of inquiring into and reporting upon the existing Parliamentary Standard as used in photometry, have at last presented a report. Unfortunately their labors were confined to the question of the standard only; they have not touched upon the photometer itself. And, therefore, many vexed questions respecting that instrument remain unanswered. So in this respect their researches are incomplete. But the fault for this omission, or limitation, does not rest

1. When this Gary Motor first appeared the present writer published an explanation of the above tenor in the *Journal of the Franklin Institute*, 1879, Vol. 77, p. 337, and in the *Scientific American*, 1879, Vol. 40, p. 324.

with the Committee, but with those who instructed them. It should also be mentioned that, although the Committee were appointed by Government, and that the inquiry has been in every sense independent and official, the expenses are to be borne by the South Metropolitan Gas Company, or at any rate that Company has guaranteed them. The report is quite of a radical nature so far as the future of Parliamentary gas testing is concerned. Both the standard sperm candle and the prescribed rate of 5 cubic feet per hour for the gas are thrown out of court. This should be clearly understood at first, because the Committee recommend that, in order to avoid confusion, the existing nomenclature should be retained, and that the results shall still be expressed in candle power. But one may question whether it would not be better to adhere to the truth, even at the risk of confusion. It does not appear quite straight for an examiner to report that a certain gas is of the value of, say, 16 candles, when as a matter of fact he has not used any candles; or to define what it is worth when consumed at the rate of 5 cubic feet per hour without having tested it under those circumstances. The Committee appear to have made very careful investigations, which thoroughly justify the conclusions at which they have arrived. The most important of these are that the Harcourt pentane standard is very exact and within all practical limits equivalent to one sperm candle, and that the 10-candle pentane Argand, as proposed by Mr. W. J. Dibdin, in 1886, is exactly equivalent to 10 candles. The last named is what the Committee propose, and what Parliament will in all probability adopt as the legal standard for the future. Besides this, however, there is an alteration of equal importance with regard to the gas. The London Argand burner is to be retained, but instead of burning the gas at the rate of 5 cubic feet per hour it is to be consumed "at whatever rate is found requisite in order that it may give a light equal to the prescribed number of candles." From the results obtained under these circumstances the illuminating value of the gas is to be calculated "as being inversely as the rate at which such gas had to be burned during the testing so as to give the amount of light prescribed." This is simply operating by the French Carcel system and calling it by an English name. It is like measuring by the metric system and calculating the results out to feet and inches. As the Committee in effect recommend a complete change, both as regards the unit to be used and the method of burning the gas, there is no reason why the old nomenclature should be retained. It will lead outsiders to believe that the old-fashioned procedure has been simply modified in a few unimportant items.

I do not propose to deal with the details of the report at present, and would merely remark that, whatever the system adopted may be, the point that gas managers have to remember is that the official photometer is not an individual. It neither pays gas bills on the one hand, nor can it go over to the oil lamp or to the electric light on the other. Nor does the consumer, whom it is the duty of the gas manager to please, so far as it lays in his power, accept it as his representative, except to a very limited extent. If he gets a good light and not too much to pay, he says the gas is good; if otherwise, he denounces it as bad, and that without any reference to the official test sheets. If these happen to agree with his own views he hails them with delight, just as he would welcome a well written political article that supported his own peculiar bias. But if not, he simply refuses to accept it. So if the business is to be established on good, sound, substantial lines, the quality of the gas must not merely satisfy the photometrical test, but also meet the needs of the district to a reasonable extent. For that reason I do not attach so much importance to the refinement of the photometrical operations to the highest possible degree as some appear to do.

The meeting of the Gas Institute is now being held in Edinburgh under favorable climatical conditions, which have no doubt contributed in some degree, together with the attractions of the locality, to draw together the large party that are at present enjoying both business and pleasure in the Scottish capital. The beautiful streets and buildings, the latter all of grey stone, the public grounds and gardens, and the magnificent views, not only from the rocky crags within easy walking distance, but from many parts of the city itself, constitute an attraction in fine weather that cannot be excelled. Then there is the wonderful Forth Bridge within easy distance, which is to be visited as an afternoon excursion. And last, but not least, there is an indefatigable local Committee, determined to do anything and everything in their power to add to the enjoyment and comfort of all the visitors. The numerous historical associations that have been attached to the place and neighborhood by the Scottish Reformers, by writers of history, by Sir Walter Scott and by Burns, need not be further enlarged upon. Every English gas manager who can possibly make his annual holiday fit in with the date of the meeting has arranged to do so.

Punctually at 11 o'clock on Tuesday morning the President, Mr. Robert Mitchell, Engineer of the Edinburgh Gas Works (which are the property of the Public Authority), faced a large gathering from the platform of the Queen Street Hall, where the meetings are held, and was supported by Sir John Macdonald, the Lord Provost of Edinburgh, and Mr. Kinloch Anderson, the Convener of the Gas Commissioners, and these gentlemen extended a hearty welcome to the Association. To Mr. Denny Lane, of Cork, was committed the task of replying on behalf of the Association, and this was discharged in his happiest vein, with an eloquent allusion to the effect of Scottish education and Scottish literature throughout the whole of the English speaking races. A special feature, at a later period of the day, was a lecture on "Illumination," by Dr. Ivison Macadam, illustrated with numerous lantern illustrations and practical experiments, but which the author kindly consented to contribute as a "paper," in order that it might be discussed. An interesting feature was the presence of Dr. Stevenson Macadam, father of the lecturer, who has attained some notoriety in connection with the scientific side of gas manufacture. Prof. Vivian B. Lewes was the chief attraction on the following morning, when there was a crowded attendance to hear his lecture on "Acetylene, and the Part it Plays in the Luminosity of Flame." The remarkable ease and clearness of deliverance on the part of the lecturer, combined with touches of humor and apt illustrations as each point was plainly unraveled from end to end, would of themselves retain the attention of an audience. But when, in addition to these desirable qualifications, it is mentioned that a very complete series of demonstrations had been provided, illustrating the production of acetylene by allowing water to drip upon calcic carbonate, the decomposition of acetylene by heat, etc., there is no occasion to add that the audience were roused to enthusiasm at times, and that the Professor resumed his seat amid a storm of applause such as rarely falls to the lot of a scientific exponent. Professor Lewes also contributed a paper on the combustion of coal gas for fuel purposes, in which he compared the cost of coal and gaseous fuels, and considered some of the sources of waste in connection with the latter. One important point was the fact that whenever the gas flame is allowed to come in contact with a solid substance, for the purpose of producing incandescence or otherwise, a certain portion escapes complete combustion and a waste of heat is the result. The Professor believes there is a future for gaseous fuel, and that by utilizing the principle of regeneration (which must not be carried too far), and by better mixing of the gas and air before combustion in the Bunsen burner, such results may be obtained as will render coal gas actually a cheaper agent than coal.

Thursday morning was occupied with a discussion on gas workers and their remuneration, the subject being introduced by a thoroughly worked out paper read by Mr. M'Crae, of Dundee; by the consideration of some points in connection with washing and scrubbing, as set forth in a paper read by Mr. Lewis T. Wright, and by the question of electricity and its effect upon the gas industry, respecting which an electrician, Mr. F. Medhurst, had the courage to stand up and set forth the subject from an electrician's point of view. With regard to workers and wages, many various experiences were put forward, according to the class of men to be dealt with. It is a subject especially deserving of consideration from all sides. For most of the difficulties in connection with matters of this kind arise from the fact that they are dealt with by those responsible for their control, in a manner that is too narrow and one-sided. As to the part which ammonia does, or can be made to play in the work of washing and scrubbing, Mr. Wright brought forward several details, based not upon theory, but upon the more solid grounds of actual experiment and research. Many of them possessed the attraction of novelty, and the whole were well received. Coming to the question of electricity *versus* gas, it is not to be expected that the opinions held by Mr. Medhurst would find general acceptance. The author has a high opinion of the future of electricity, and spoke confidently of a time when less gas would be used and more electricity. To which several speakers rejoined by quoting examples of things as they have been and still are.

Altogether the meeting was a great success, and all who went to Edinburgh will return to their respective duties not only renovated in bodily health by their stay in that beautiful city, but strengthened in mind, and better able to cope with the difficulties that befall them in their respective spheres of duty. Another point is worth mentioning. The writer availed himself of the opportunity for examining some of the principal educational establishments for which Edinburgh is so justly celebrated, and was gratified to find in connection with the principal University of the city, which comprises a set of magnificent stone buildings, that cost some £750,000, not only a complete series of chemical laboratories, but a large room set aside expressly for the subject of

gas analysis, and fitted up in the most complete manner with several sets of apparatus for enabling researches of this nature to be carried on by the students. It was interesting to learn that this subject is so popular with the pupils that many have come in from other departments to perform analyses of gas in their spare time without having had instructions to do so.

The Commercial Value of Monazite.

The *Scientific American* says it begins to look as though the great value of monazite mining lands had been very much overestimated. There is, of course, a demand for rare earth oxides for the manufacture of incandescent gas lamps, etc., but the supply of monazite is, unfortunately for the speculator, practically unlimited, and its price has dropped correspondingly.

Monazite was so called in allusion to its supposed rarity. For a long time subsequent to its discovery in Norway it was believed to exist nowhere else. It was afterwards found, however, in Silesia, Bohemia, Belgium, England, Brazil and the United States. The deposits in this country are near Norwich, Conn., and in North Carolina. Monazite is in substance a phosphate of cerium, lanthanum and didymium, containing silicon and thorium in variable proportions, probably as impurities. The oxides of the rare earth metals, cerium, thorium, yttrium, erbium, lanthanum and zirconium possess the peculiar property of becoming incandescent at a moderate heat. The light emitted is the greatest in the case of thorium, and this oxide of this metal is obtained principally from monazite. It is used extensively in the Welsbach lamp, where a network mantle of the oxide is suspended over a Bunsen burner and produces an intense white light.

When monazite was discovered in North Carolina, great excitement prevailed for a time. Fabulous stories of the value of the resinous-looking substance were circulated, and sand from the river bottoms was carefully washed over in cradles like those used by the gold prospectors of California. Some of the pioneers made a good deal of money at first, but, as the washing process is exceedingly laborious and slow when conducted by hand, and many tons of sand must be washed to extract one of monazite, nobody got rich. Nevertheless, the people all believed firmly that immense fortunes could be made with proper apparatus for mining, and chemists and engineers in the Northern cities were overwhelmed with letters and circulars in which monazite lands were offered as great bargains at absurdly high prices.

Meanwhile the representatives of the consumers had quietly placed contracts at the lowest possible figure, and the price of the mineral be gan to drop. As last winter was a severe one, and the ice in the rivers interfered with the washing, good, clean monazite sand sold for 15 cents a pound. Now it can be had for 5 or 6 cents, and there is not a great demand at that. It is doubtful whether the entire output of North Carolina since the discovery of the mineral has brought $125,000.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE properties of the Beatrice (Neb.) Rapid Transit and Power Company, in which is included the electric lighting system, are to be sold at auction on the 3d inst., by order of the United States Circuit Court.

AT the annual meeting of the shareholders in the Quincy (Ills.) Gas Light and Coke Company no change was made in the executive management thereof.

THE protest of the Peoria (Ills.) Gas Light and Coke Company to the City Council against the granting of a franchise to other parties for the right to operate an opposition gas company in that city includes the following statement: "We furthermore desire, gentlemen, to bring to your notice that the rates charged for gas in Peoria—to wit, $1.25, $1.15, $1, and 75 cents—are less than those charged by any other city in the country, considering population and location, and where legitimate rules of business are observed."

THE following is from a correspondent at Long Branch, N. J., under date of June 22d: "The Township Committee of Asbury Park, N. J., has granted a franchise to the Consolidated Gas Company, of New Jersey, to lay gas mains within the township limits, which means another step in the direction of supplying gas to the district between Red Bank on the north, and Spring Lake on the south, from a central plant located at Long Branch. The Asbury Park Gas Light Company, in view of the progress thus far made by the Consolidated Gas Company, has decided to dispose of its plant to the latter. I do not know what the consideration agreed upon was, but it is understood that a fair price was obtained. It is thought that the Asbury Park works will be dismantled, which determination, however, may not include the taking down of the gasholder."

ADVICES from Santa Fe, New Mexico, are to the effect that the Santa Fe Gas Company has determined to go out of business. The date for the shut down is the 2d inst.

THE Council of Dayton, Ohio, has agreed upon the special levy for the public lighting of the city, the amounts being as follows: 7-10ths of one mill on each dollar valuation for all streets lighted by gas, and 1.2 mills on the valuation for all streets lighted with electricity.

MR. WM. L. TAYLOR, of Indianapolis, Ind., acting as attorney for the Fort Wayne Electric Company, has applied to the City Council, of Brazil, Ind., for a franchise for the operation of a gas, electric light and power plant, which grant is to be made in consideration of the benefits to accrue to the place from its operation. It is further proposed that the grant shall be perpetual. Brazil is the capital of Clay county, Ind., and is on the St. Louis, Vandalia, Terre Haute and Indianapolis Railroad, at a point 16 miles east-northeast of Terre Haute and 57 miles west-southwest of Indianapolis. It has valuable and extensive mines of coal, and is noted for its important manufactures of pig iron. Its population numbers about 2,000, and it is a likely place for the venture proposed by the Fort Wayne Electric Company.

THE Milwaukee Gas Company keeps putting before the residents literature of the sort calculated to attract their attention to the value of gas for cooking purposes. The last of the series is of the type that may be called "the before and after," the main sheets being given over to quite an amusing picturing of how "the home" appeared when the mistress thereof used a coal range, and later how it looked when the mistress was the contented proprietress of an improved gas range.

IT is only a question of time (and of short time, too) now when the settlement of the prolonged war of rates at Terre Haute, Ind., will be announced. The syndicate, headed by Mr. McIlhenny, of Philadelphia, will undoubtedly dictate the gas policy to prevail hereafter at Terre Haute.

THE proprietors of the Easthampton (Mass.) Gas Company have installed a 50-arc generating plant of the Thomson-Houston type, the lamps of the double carbon order. This apparatus replaces a Waterhouse set.

THE Cambridge (Mass.) Gas Light Company is completing a new purifying house on Third street. Its dimensions are 85 feet by 61 feet, and the builder in Mr. M. N. Stearns.

AT the annual meeting of the Raleigh (N. C.) Gas Company the officers chosen were: Directors, C. M. Hawkins, G. Rosenthal, H. W. Jackson, B. S. Jerman, W. T. McGee. J. R. Ferrall, B. P. Williamson, A. M. Powell and W. B. Grimes; President, Capt. B. P. Williamson; Vice-President, H. W. Jackson; Secretary and Treasurer, W. T. McGee.

THE Louisville (Ky.) *Courier-Journal*, of June 23d, says: "The Central Electric Company is trying to get a monopoly of the lighting business in Lexington, Ky. For some time it has had its eye on the Lexington Gas Company's plant, but being unable to buy out that institution it is considering the project of starting an opposition Gas Company. Gas is sold at $2 per 1,000 cubic feet in Lexington." We have no doubt that the Central Electric Company would like to secure a monopoly of the lighting business of Lexington, since if it secured control of the Lexington Gas Company it could put its electric lighting rates on a basis that would enable it to really earn some money on the capital invested in that part of its business—the Central concern also carries on the trade of ice making and operates a system of electric street railway. The proprietors of the Lexington Gas Company, however, have had a pretty good thing for some years, and thus know full well the value of their property; furthermore, if our knowledge of the situation counts for anything, they are not likely to be forced out of their holdings through any such cheap threat as that put forth by the Central's electricians. If the Lexington Company returned to the manufacture of coal gas, which, from the local situation and its circumstances, it never should have abandoned, the net selling rate could easily be cut to $1.50

per 1,000, a proceeding that would speedily oblige the Central concern to pack itself in its own ice to enable it to remain on the ground instead of under it.

THE old-gold Governor of Illinois has vetoed House bill No. 801, passed by the 39th General Assembly of the State, which provided that before any local authority could grant a franchise to any gas or electric light company to lay gas pipes or string wires under or over any street, the proprietors of the company should be obliged to show that they had obtained the consent of a majority of the property owners along the proposed lines as represented by their frontage ownerships in each mile. The bill was a fair one, but its seeming defect to the eyes of the old golden one was that it conflicted with the principle that populistic ideas should rule.

A CORRESPONDENT forwards the following: "During the week ended June 22d, an exhibition of the various uses to which gas can be put was brought to a close in Utica, N. Y., the exhibition having been held in the spacious premises, No. 172 Genesee street. To a novice (in which class I am), the exhibition was of remarkable interest, and its purport was to show the excellence of gas as a fuel for use in cooking, heating water, and so on. All the appliances necessary for the use of gas in the kitchen were shown at the demonstration, and the lecturers in charge of the illustrations accomplished many interesting results. The gas ranges roast turkey and meats in 12 minutes to the pound; broil steak in 4½ minutes; bake bread in 29 minutes; biscuit in 10 minutes; short cake in 12 minutes; the ordinary kinds of loaf cake in 13 minutes. The heater heats 30 gallons of water in 1 hour and 15 minutes with an expenditure of 5½ cents worth of gas. To my mind, gas as cooking fuel, with gas at $1.50 per 1,000, is much cheaper than coal at $5 per ton. It cooks to perfection, as the table covered with the products of the gas range at the exhibition easily proves. People attended the exhibition in large numbers, and the whole affair was arranged by Mr. E. A. Pinkney, the well-known Superintendent of the Equitable Gas and Electric Company. In order to facilitate the extension of the use of gas as fuel, the Company has made arrangements with Messrs. Roberts, Perry & Co. to handle gas ranges at practically cost price.—F."

THE death of Mr. Daniel Dodd, formerly prominent in the administration of the affairs of the Newark (N. J.) Gas Light Company, occurred on the 24th inst., at his home, 27 Saybrook place, Newark. The *Sun* notes that he was born in Orange, N. J., on January 15th, 1817, and was educated at the University of the City of New York, from which he was graduated in 1835. He studied law in Newark, and was admitted to the bar in 1839. When William Pierson was elected Sheriff of Essex county, Mr. Dodd became under-Sheriff, and was afterwards legislative reporter for the Newark *Daily Advertiser*, in the early forties. Afterwards he was Secretary of the New Jersey Insurance Company, and in 1860 was elected Treasurer of the Newark Savings Institution, then one of the strongest banks in New Jersey. In 1871 he was elected President of the bank, and in the same year was elected President of the Newark Gas Light Company, being succeeded in the latter position some years afterward by Mr. Eugene Vanderpool. He remained President of the bank until its failure, December 12th, 1877, the cause of which was attributed to his investment in Chesapeake and Ohio railway bonds, which were depreciated greatly after the panic of 1873. Chancellor Runyon permitted the bank to reorganize, as a ward in Chancery, and Mr. Dodd was put in charge of its affairs. The failure of Fisk & Hatch precipitated a second failure of the bank, in 1884, and it went into the hands of a receiver. Mr. Dodd was a staunch Republican, and was a member of the Newark Common Council, from 1856 to 1859, when he was nominated for Mayor and was defeated by Moses Bigelow. From 1860 to 1879 he was a member of the Newark Aqueduct Board. In 1873 he was appointed a Sinking Fund Commissioner and served 11 years. He was a Vestryman of Trinity Church for 25 years, and Treasurer of the State Convention, the Episcopal Fund and other financial trusts of the Episcopal Church in New Jersey. He leaves a son and two daughters.

MR. JONES, Chairman of the Board of Public Works, of Knoxville, Tenn., has proposed the following notice respecting the public lighting of that city: "Sealed bids will be received by the Board of Public Works at their office in Knoxville, Tenn., until July 11, 1895, at 2 o'clock, P.M., for lighting the city with electricity or gas. For 200 arc lights, 2,000-candle power each, all night service; or 800 to 1,000 gas lights, of 18 to 20-candle power; either contract to run for the term of 5 or 10 years. All bids must be based upon the form of a contract, which may be had upon application. Also, bids will be received for the erection of an electric light plant to be paid for in yearly installments in 5 or 10 years, the city to take charge of and operate the same within 30 days after completion. Certified check for $1,000 must accompany each bid. The right is reserved to reject any and all bids, or to let the contract to the most satisfactory bidder. Specifications for erection of plant will be furnished upon application."

MRS. ANNIE GANNON, widow of William Gannon, brought suit against the Laclede Gas Light Company for damages in the sum of $5,000, occasioned by the death of her husband. Deceased, who was a member of Engine Company No. 32, of the St. Louis Fire Department, on the evening of April 18, 1894, while in the performance of his duty, in assisting to extinguish a fire in a building located on an alley directly in the rear of 2737 Thomas street, was struck by a loose live wire which formed a portion of an arc lighting circuit of the Gas Company, and was killed by the contact and current. Plaintiff contended that defendant was negligent in failing to cut off the current from fire-affected territory, and the jury evidently indorsed that view, since a verdict for $3,000 damages was returned.

THE properties of the Eastport (Me.) Gas and Electric Company will be offered at auction on the afternoon of August 15th, because of default in interest on a mortgage, the trustee of which is the American Loan and Trust Company. The sale will be absolute.

THE proprietors of the Riverside (Cal.) Gas Company have determined to overhaul the plant in the most thorough manner. The scrubbing and purifying apparatus will be reconstructed on an enlarged scale.

WHAT is known as the Frank E. Bruere gas ordinance for a gas works at Jacksonville, Fla., has certainly a very fishy appearance; at least so we are informed by a correspondent, who adds that it provides "for a franchise for 99 years for the exclusive privilege of supplying gas as a fuel and as an illuminant in the Riverside and Brooklyn districts for a period of 15 years, the supply to be carried on in other parts of the city when the growth of the city shall justify such extension. The free use of the streets, alleys, bridges, viaducts, public squares and parks was stipulated, and it was agreed that the franchise should be forfeited if the plant should not be completed within 22 months. It was further declared that the Company should pay to the city of Jacksonville 2 cents per 1,000 cubic feet on a daily output of 20,000 cubic feet; 3 cents per 1,000 on an output of 40,000 to 60,000; 4 cents on 60,000 to 100,000; 5 cents on 100,000 to 148,000; and $5,000 per year on a daily production of more than 148,000 cubic feet." Our correspondent adds that Mayor Fletcher is opposed to the Bruere scheme.

THE estate left by the late Mr. Eustace C. Fitz amounts to more than a million of dollars. The following are the sums bequeathed by him to public institutions: Brown University, $5,000; Colby University, $5,000; Wellesley College, $10,000; Newton Theological Seminary, $10,000; American Baptist Missionary Society, of Boston, $10,000; American Baptist Home Missionary Society, of New York, $10,000.

SOME days ago the Board of Public Works and the Council Committee on Gas and Electric Light, of Evansville, Ind., met for the purpose of considering the bids submitted in response to invitations to bid on the public lighting of the city for five years, from August 11, 1895. The bidders were the Evansville Gas and Electric Light Company and the Peoples Electric Light and Power Company. The first-named offered to furnish and maintain 250 arc lamps at the rate of $95 per lamp per year, and 250 gas lamps, or as many more or less as the city may require, fitted with the Welsbach burner (after the manner of the lamps now in use on First street, Evansville), at the rate of $20 per lamp per annum. The lighting is to be carried out on an all night and every night basis. The Peoples Electric Light and Power Company offered to light and maintain 400 arc lamps at the rate of $119.43 each per annum. As the advertisement for bids specified the need of the city to be 400 arc lamps, the Gas Company's proposition gave rise to a heated discussion, in the course of which the Electric Company's representative (Mr. Buchanan) claimed that the joint committee had no right to consider the Gas Company's proposition at all, since it did not comply with the specifications. Mayor Hawkins, however, thought the Gas Company's bid was clearly in the interest of the city, and on his suggestion City Attorney Cunningham was instructed to submit a written opinion as to whether the contract can be legally awarded to the Evansville Gas and Electric Light Company. Mr. Cunningham's opinion was to have been handed in last Saturday.

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PROPRIETORS.

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MONDAY, JULY 1, 1895.

The Cost of Electrical Supply.

Engineering Magazine, for June, says: The actual cost of supplying electrical energy to consumers, especially in the form of light, is a matter about which there has already been a great deal of discussion, but in respect to which very much yet remains to be learned. Another problem closely related to this is that of the most equitable basis of charge to consumers, and it is one which presents a great many difficulties. In the London *Electrician* Arthur Wright has recently published a very instructive paper, in which he gives the results of the methods adopted by him at the station in Brighton, England, a town having some of the social and commercial characteristics of our own Newport. Mr. Wright's general plan may be said to be that of charging a high rate per unit consumed, until each consumer's proper portion of the fixed charges has been reached (these latter amounting in the case of the Brighton station to 80 per cent. of total expenditure), and above that point, of making a material reduction. He points out that, were it not for the fact that only some 13 per cent. of the consumers use the light at all during three months in the year (an average of less than one hour per day), the present plant would be of ample capacity to supply the increasing business for at least two years, whereas, by reason of their existence, it is necessary to install additional plant to take care of the winter's load. The item of expenses includes really but two divisions, fixed charges and running cost, and hence, as Mr. Wright points out, it is necessary only to have two rates of charge for the consumer in order to obtain a perfectly equitable sliding scale of rebates, which, he assures us, involves but little more clerical work than a uniform price system. Mr. Wright insists strongly upon the superiority of a system giving rebates based on a consumer's actual use of the generating plant and conductors over one based on the more or less prolonged use of all the lamps installed. The former encourages the general use of electric light, while the latter has a contrary effect, and is, moreover, based on an unsound principle, as the preponderating fixed charges are not altered in any way by the proportion of the total number of lamps in a house which remain unlighted.

Petroleum Production in the United States.

Stowell's *Petroleum Reporter* declares that the total production of petroleum in the United States in 1894 was some 49,344,516 barrels of 42 gallons each, as compared with 48,412,666 barrels in 1893. Most of this production is in the Appalachian oil fields, that is, in New York, Pennsylvania, West Virginia and Eastern Ohio, some 30,781,924 barrels coming from this field, 17,296,510 barrels from the limestone districts of the Lima-Indiana field, from the Colorado, 515,746 barrels, and from California, 705,969. As compared with 1893, production declined some 600,000 barrels in the Appalachian field; increased some 1,300,000 barrels in the Lima-Indiana; decreased some 80,000 barrels in the Colorado, and increased some 240,000 in California.

The Market for Gas Securities.

City gas shares were dull and lower during the week, notably Consolidated, 200 shares of which were sold on the Exchange this morning (Friday) at 143½. There is no real reason for the decline, unless it be that it is in sympathy with the rumors referring to a change in the Brooklyn situation. If our friends across the river would only exorcise the Equity ghost and get down to real business there would be no doubt about a bull movement in city gas shares. Brooklyn quotations are unchanged and are nominal only.

The real feature of the week was the break in Chicago, which sold down this morning to 63, but which at noon had recovered to 64¼. The veto of the frontage bill by Governor Altgeld is the cause of the slump, and the weakness may be further attributed to the fear that the Company may be unable to pay more than 4 per cent. on its stock. So far, President Lincoln's administration of its affairs cannot be said to have been remarkably successful. Lacledes are somewhat in disfavor, and a like statement applies to Bay States. Consumers, of Jersey City, is 85 bid, and Western, of Milwaukee, is steady. The dividend on Standard common is deferred until the fall. The U. G. I. Company has declared its regular quarterly dividend of 2 per cent., payable July 15th.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

JULY 1.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,330,000	100	143¾	144
Central	500,000	50	140	..
" Scrip	220,000	..	100	..
Equitable	4,000,000	100	196	199
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	112	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	170	..
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	
Northern	150,000	50	90	91
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	30¾	31¼
Preferred	2,000,000	100	54¾	55¾
Bonds	3,500,000	1,000	..	98½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	..	..	..
Standard	5,000,000	100	66	68
Preferred	5,000,000	100	107	109
Bonds, 1st Mortgage, 5's	1,500,000	..	105	..
Yonkers	.....	50	101x	.
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	330,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	108	..
Peoples	1,000,000	10	90	.
" Bonds, 7's	368,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	225	..
" Ctfs.	700,000	1,000	99	100
Williamsburgh	1,000,000	50	210	..
" Bonds	1,000,000	..	107	110
Out-of-Town Companies.				
Bay State	5,000,000	15	17	23
" Income Bonds	2,000,000	1,000	27	..
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	78	80
2d " " "	3,000,000	1,000	52	53¾
Buffalo Mutual	750,000	100	126	..
" Bonds	200,000	1,000	95	100
Chicago Gas Co.	25,000,000	100	64¼	64½
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	93	93½
Columbus	1,069,000	..	..	..
1st Mortgage	1,085,000	..	..	..
Consumers, Jersey City	2,000,000	100	85	..
" Bonds	600,000	1,000	100	..
Cincinnati G. & C. Co.	7,000,000	100	202	203
Consumers, Toronto	1,600,000	50	184½	187
Central, San Francisco	.....	..	90	100
Capital, Sacramento	.....	..	..	50
Consolidated, Baltimore	11,000,000	100	69¾	69¾
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	29	..
" Con. Bonds	4,312,000	..	69	70
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	73¼	75
" Bonds	2,000,000	..	84	86
Hartford	750,000	25	120	123
Indianapolis	2,000,000	..	160	..
" Bonds, 6's	2,650,000	..	106	..
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	84	86
Bonds	1,000,000	1,000	86	88
Louisville	2,370,000	50	..	130
Laclede, St. Louis	7,500,000	100	26	27
Preferred	2,500,000	100	84	87
Bonds	9,084,400	1,000	95	96½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	..
New Haven	.....	25	225	..
Oakland, Cal.	.....	..	42½	43
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	90	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000	..	87½	90
Syracuse, N. Y.	500,000	25	..	..
San Francisco, Cal.	10,000,000	100	73½	73¾
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	64¼	66¼
Bonds, 5's	3,556,000	..	92¾	93½
Wilmington, Del.	500,000	50	188	190

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., 813 DREXEL BUILDING, PHILA., June 27, 1895.

The Directors have this day declared a quarterly dividend of 2 per cent. ($1 per share), payable on July 15, 1895, to stockholders of record at the close of business July 1st. Checks will be mailed. EDWARD C. LEE, Treas.

SUPERINTENDENT.

Wanted, a thoroughly practical and experienced Coal Gas Man as

Supt. of Manufacture in a Large Works.

Reply, with age, experience and references, to "SUPERINTENDENT,"
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Position Desired

As Superintendent or Manager of Gas Works

By an active, pushing man of 30, who was reared in a gas works. Will take the entire management of a Gas and Electric Light Plant or Water Works. Experienced in all the details of manufacture and in the construction of plants. Can furnish best of references. Has been Supt. of a Gas Works for 10 years. Address
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As Manager of a Gas Works or Gas and Electric Light Works.

Has successfully managed Gas and Electric Light Plants for the past five years.
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Is capable and energetic, and is willing to begin at a moderate salary. Address
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Must be in good condition and cheap. Address "GAS," 80 Moffat Block,
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10 ft. by 15 ft. by 3 ft., 24-inch Cups, with Center Seal and Connections, all in good condition. Address
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ARE 'WAY DOWN.
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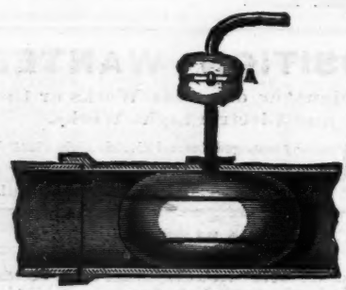
Peerless Patent Improved Gas Bag



These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and sometimes fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficiently inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

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5 " " "	1.05	20 " " "	12.00
6 " " "	1.75	24 " " "	17.00
8 " " "	2.65	30 " " "	27.50
10 " " "	3.75		

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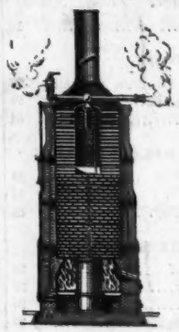

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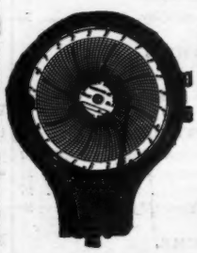

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Mechanical Engineer,

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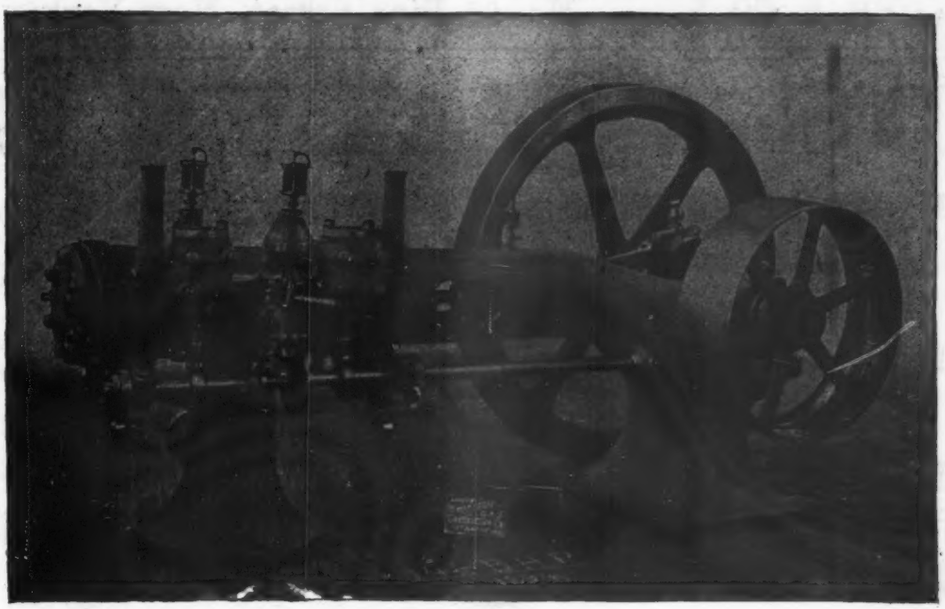

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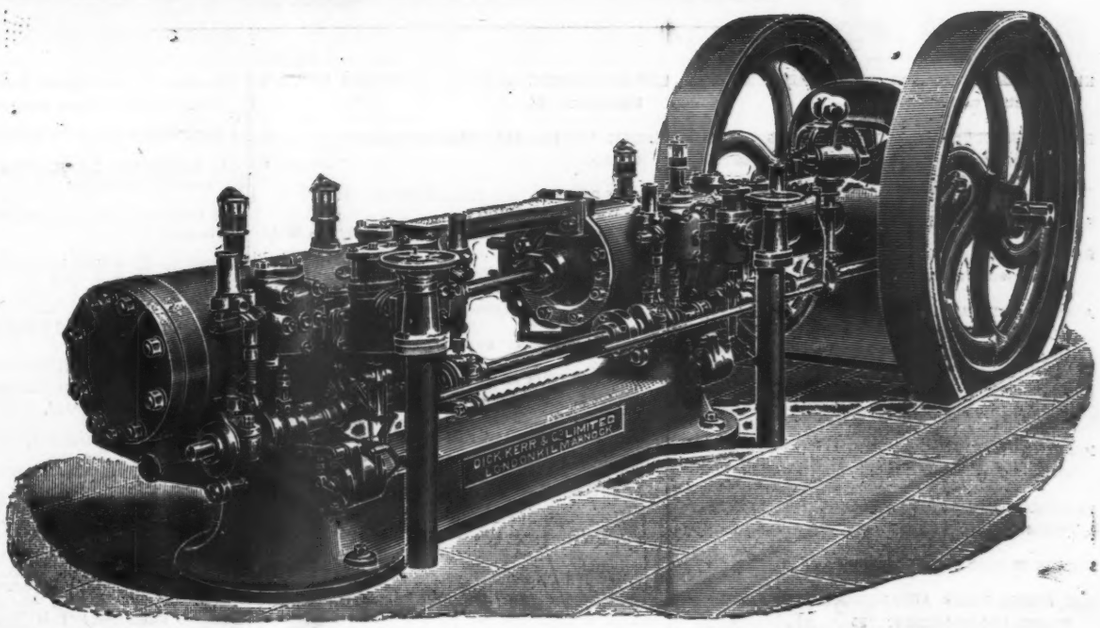

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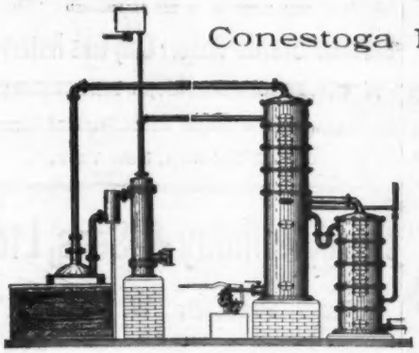

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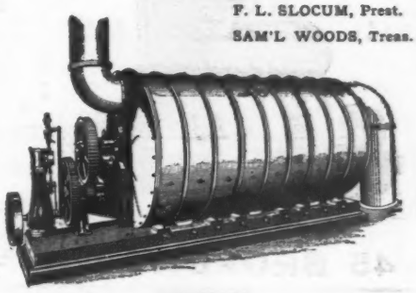

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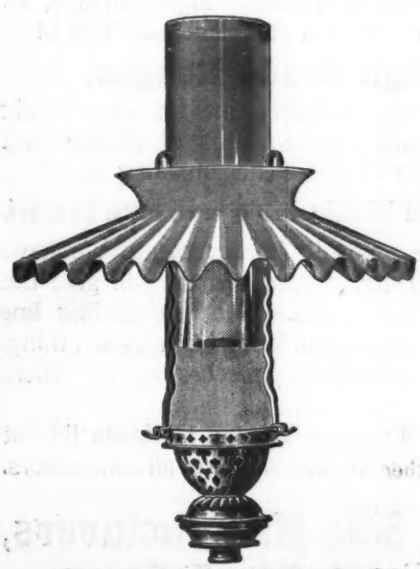

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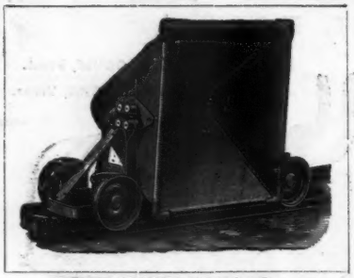

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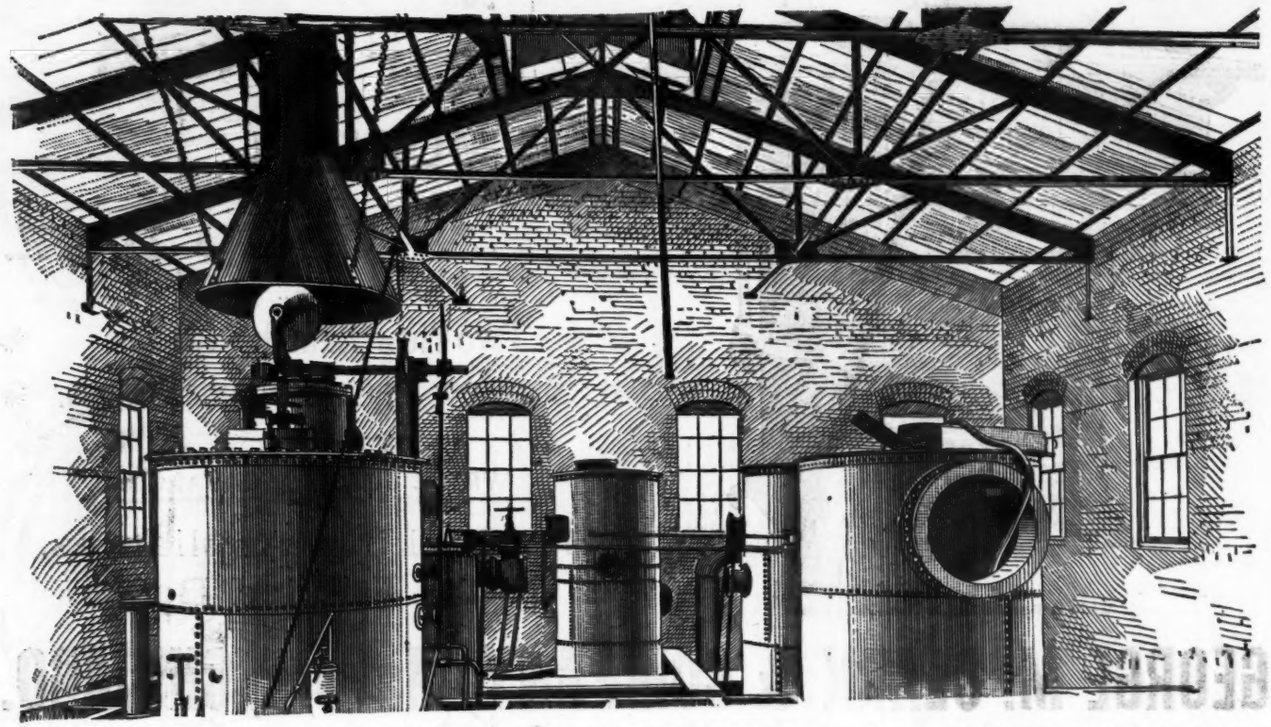

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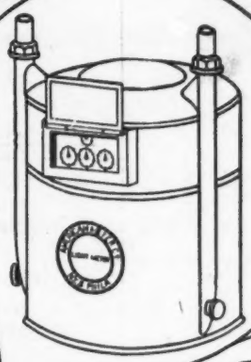
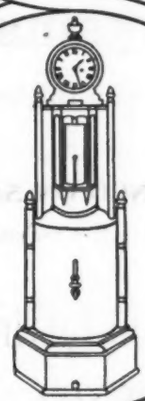
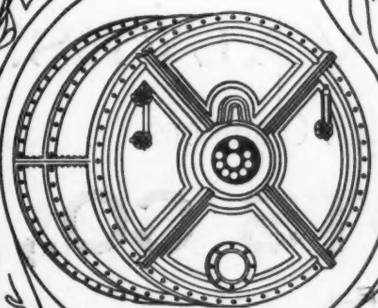


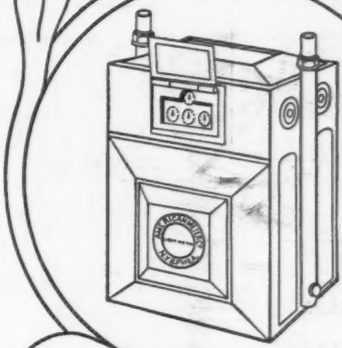


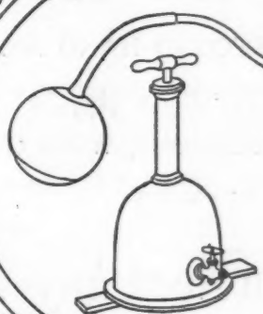


PUBLIC LIGHTING TABLE.

JULY, 1895.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. Extinguish.
				P.M.	A.M.
Mon.	1	11.50 PM	3.40 AM	7.30	3.15
Tue.	2	12.20 AM	3.40	7.30	3.15
Wed.	3	1.00	3.40	7.30	3.15
Thu.	4	1.50	3.40	7.30	3.15
Fri.	5	No L.	No L.	7.30	3.15
Sat.	6	No L. FM	No L.	7.30	3.15
Sun.	7	No L.	No L.	7.30	3.15
Mon.	8	8.00 PM	10.00 PM	7.30	3.15
Tue.	9	8.00	10.20	7.30	3.15
Wed.	10	8.00	10.50	7.30	3.15
Thu.	11	8.00	11.10	7.30	3.15
Fri.	12	8.00	11.30	7.30	3.15
Sat.	13	8.00	11.50	7.30	3.15
Sun.	14	8.00 LQ	12.10 AM	7.30	3.15
Mon.	15	8.00	12.30	7.30	3.15
Tue.	16	8.00	1.00	7.20	3.15
Wed	17	8.00	1.40	7.20	3.15
Thu.	18	8.00	3.50	7.20	3.15
Fri.	19	8.00	3.50	7.20	3.15
Sat.	20	8.00	3.50	7.20	3.15
Sun.	21	7.50 NM	3.50	7.20	3.15
Mon.	22	7.50	3.50	7.20	3.15
Tue.	23	7.50	3.50	7.20	3.15
Wed.	24	7.50	3.50	7.20	3.15
Thu.	25	7.50	3.50	7.20	3.15
Fri.	26	9.00	3.50	7.20	3.15
Sat.	27	9.20	3.50	7.20	3.15
Sun.	28	9.50 FQ	4.00	7.20	3.15
Mon.	29	10.20	4.00	7.20	3.15
Tue.	30	11.00	4.00	7.10	3.30
Wed.	31	11.50	4.00	7.10	3.30





TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

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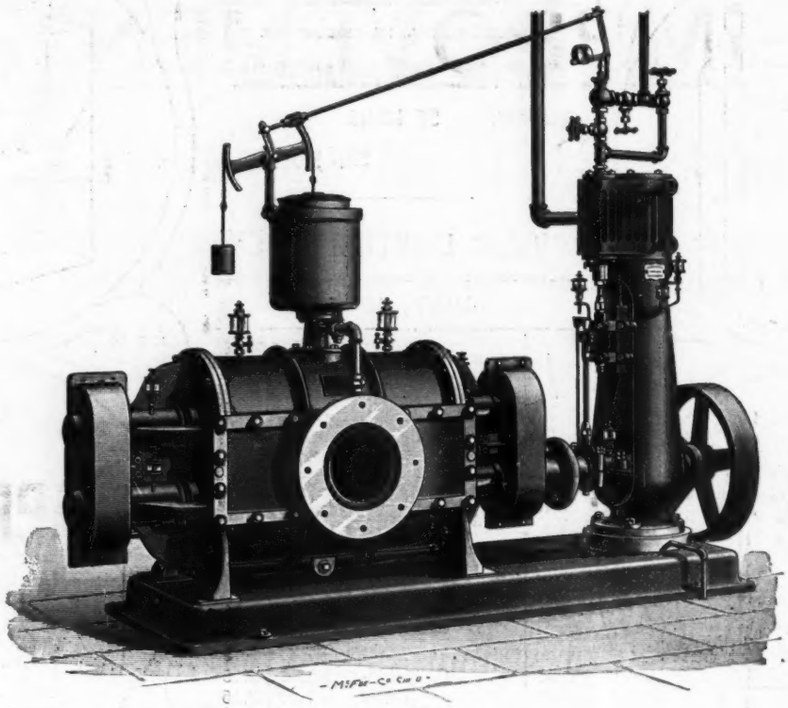

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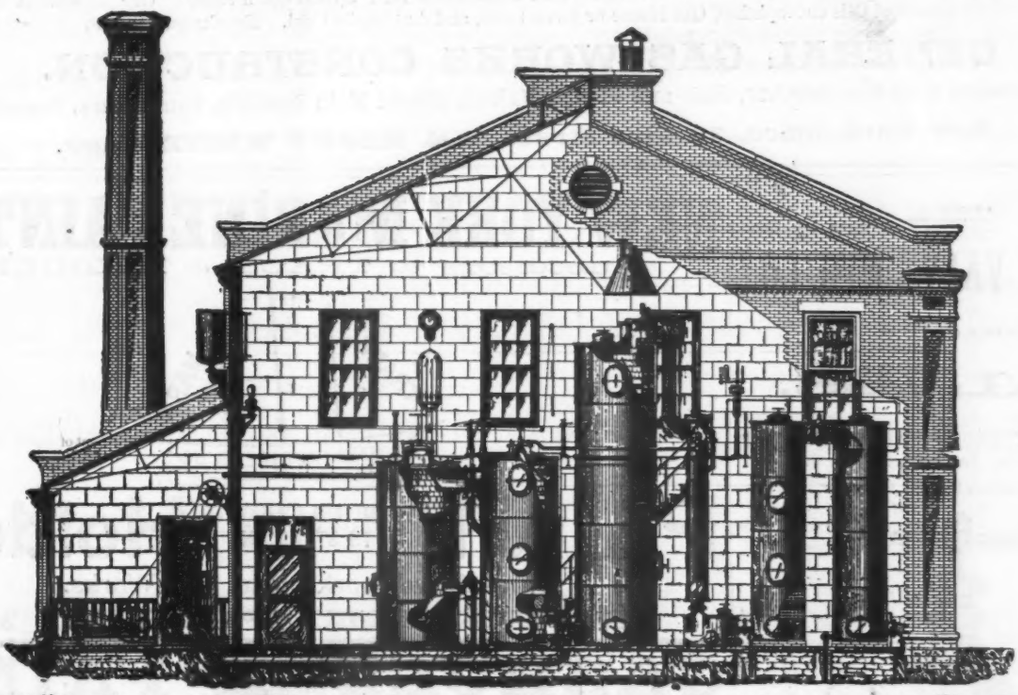

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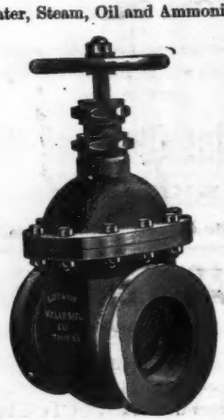

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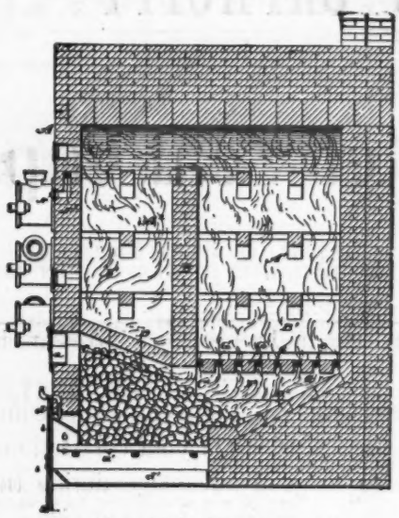

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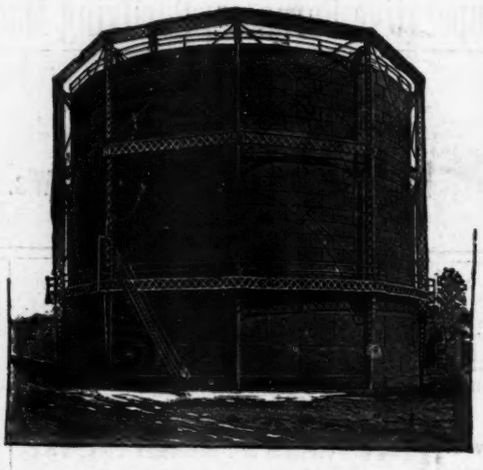

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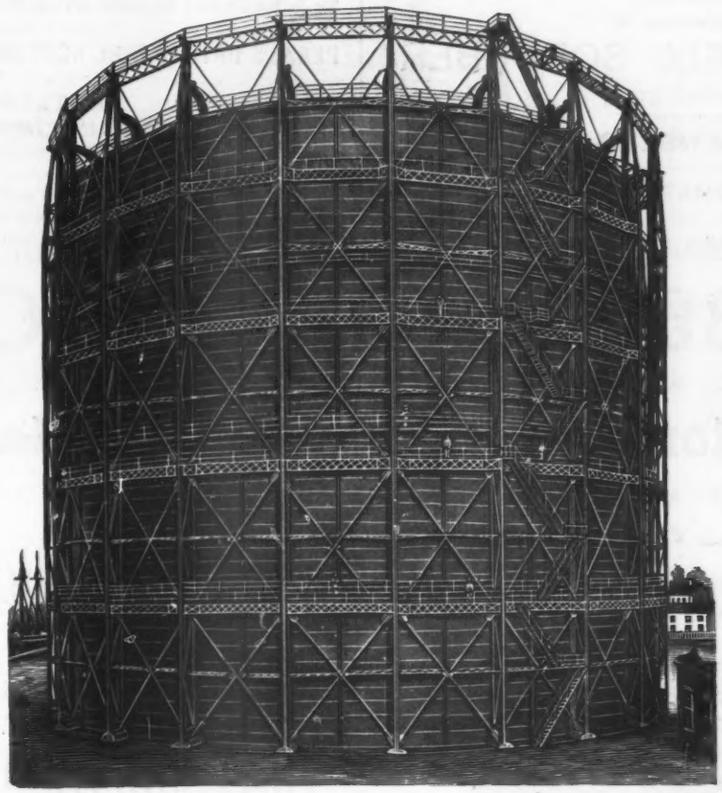

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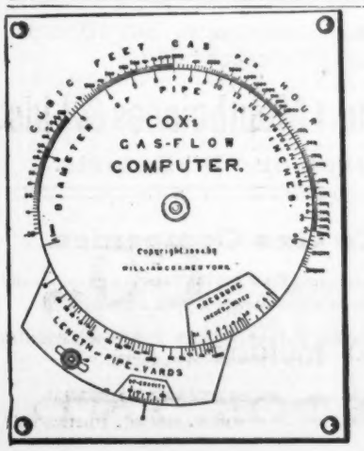

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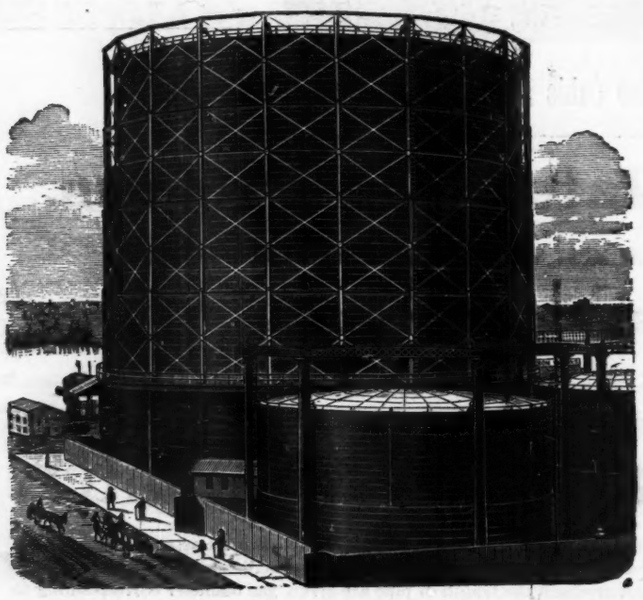

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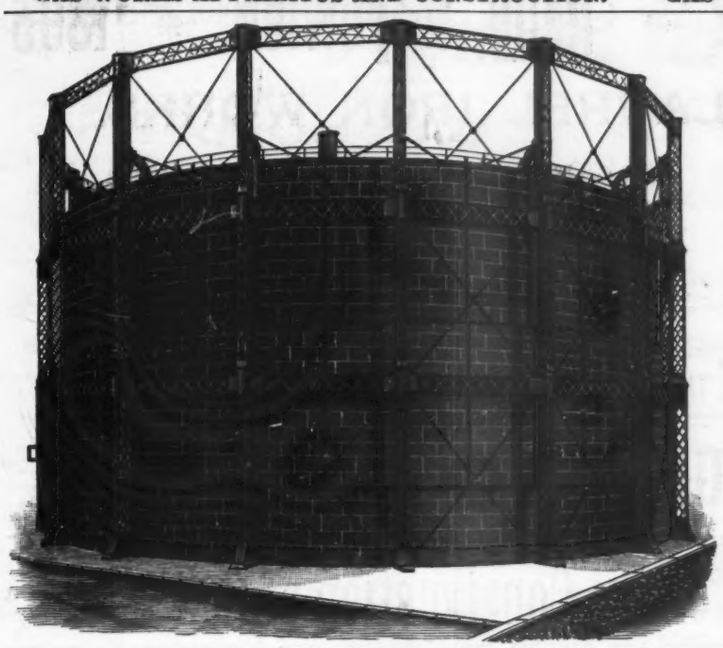

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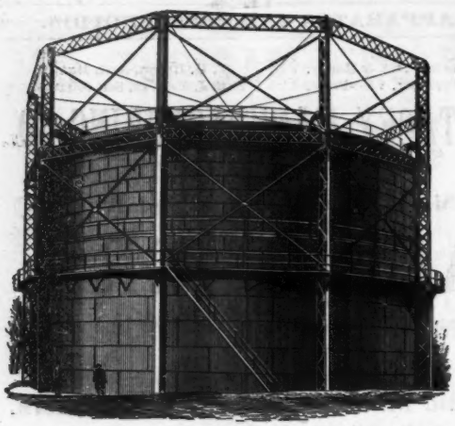

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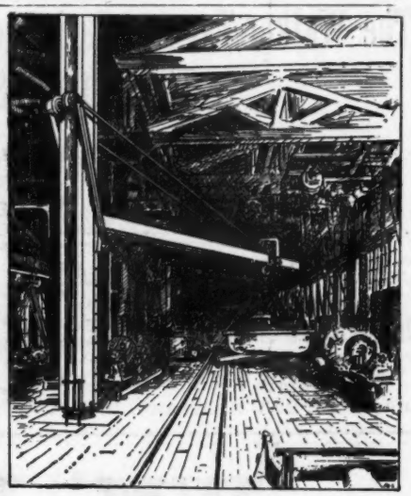

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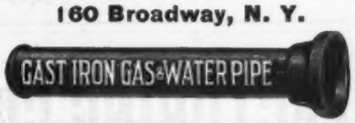

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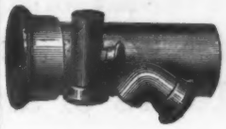

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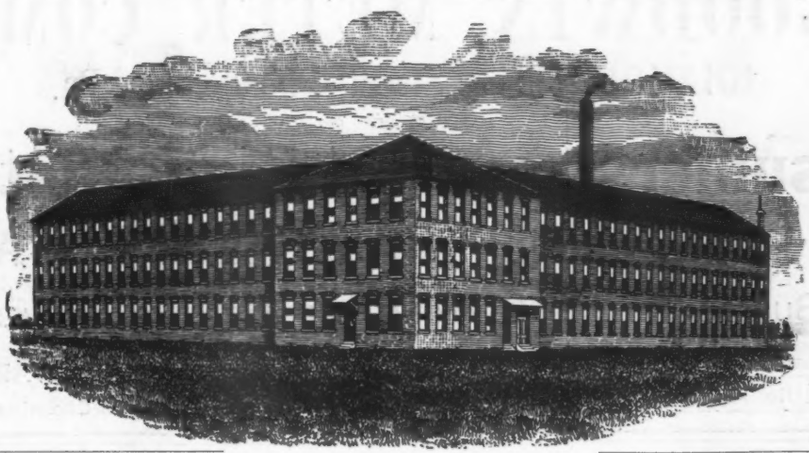

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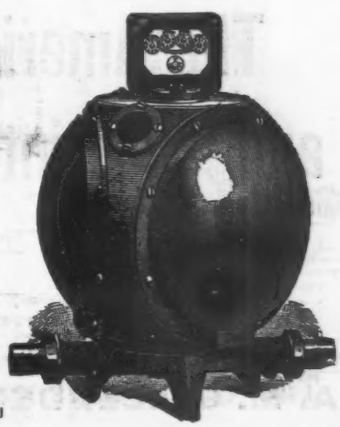

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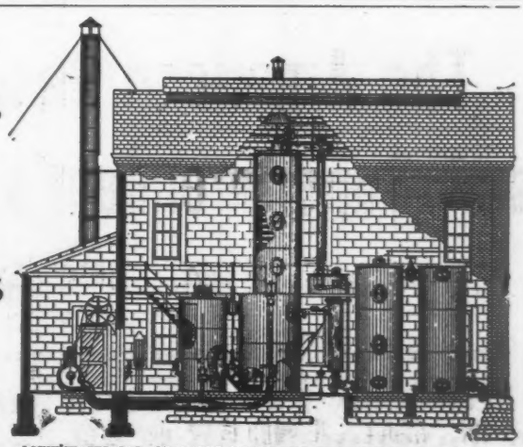

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